ISADORA®

User's Manual

By Mark Coniglio

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Isadora – Overview

What is Isadora?

Isadora is a software program designed to allow interactive, real-time manipulation of digital media, including pre-recorded video, live video, sound, standard MIDI files and more. You create an Isadora program by linking together modules (called *actors* in Isadora parlance), each of which perform a specific function on the media. You make these programs interactive by linking actors to another type of module, called a *watcher*, which looks for information from the outside world (i.e., MIDI messages, mouse and keyboard actions, messages send over a Local Area Network). The results are presented via the computer's video screens, speakers, or MIDI interfaces.

The design of Isadora is the result of over a dozen years of experience of creating interactive works with my dance theater company Troika Ranch (http://www.troikaranch.org), as well as my experience teaching numerous workshops on integrating digital media into live performance. It reflects my own desire for a flexible, powerful and reliable tool with which to make my own pieces, and to create a friendly working environment for those who do not have extensive computer experience.

Perhaps the most difficult aspect of Isadora is that a new file is a blank slate – it won't do anything for you until you begin to bring actors into the program and link them together. For those just beginning, this can be a bit daunting. So, we have supplied a complete set of tutorials that lead you through the process of creating several Isadora programs. In addition, you will find several example files included with the application. Looking at these may be the best place to start, as it will give you a sense of what you can do with Isadora and how to begin using it.

On the other hand, those who have more experience with media manipulation software may want to head directly for the *Quick Start* section. It gives the essential information required to start using the program.

It is worth mentioning here that help is always available. Control clicking (on MacOS) or the right clicking (on Windows) on an Isadora module will display a pop-up menu. Choose "Actor Help…" to display help information for that module. To see help for an input or output, control or right click the name or value of an input or output and choose "Actor Input Help…" or "Actor Output Help…" as appropriate.

Enjoy,

Mark Coniglio

Quick Start

If you don't like reading manuals, here are the essential things you need to know to use Isadora.

• It is rather important that you set up the preferences correctly for your system. At the very least, follow the instructions regarding "Setting Up Isadora Preferences" under the "Preparing Your Computer" section of this *Tutorials* chapter below.

• If you intend to use MIDI, you should specify the input and output routing to your MIDI interface by choosing **Windows > MIDI Setup....** Note that you should plug your MIDI interface into your computer (and install its drivers) prior to starting up Isadora – otherwise Isadora won't see the interface.

• An Isadora document has three main areas: the Toolbox (located along the left side), the Scene List (located along the bottom) and the Scene Editor, which takes up the remainder of the window. Each Isadora Scene is a complete program, made up of one or more modules (called an *actors* in Isadora parlance) that manipulate video, sound or data.

• The actors used to create a Scene are found in the Toolbox. There are eight groups of actors within the Toolbox – click on the numbers above the Toolbox to see the actors associated with each group.

• To bring an actor into the Scene Editor, click on the module name in the Toolbox. The cursor will change into a plus sign to let you know you're about to add an actor. Then, move the mouse into the Scene Editor area on the right. When the new module is positioned where you want it, click again to deposit it into the scene.

• To delete an actor, select it and then choose **Edit > Clear** or press the delete key. You may select multiple actors by holding down the shift key while clicking, or select a group of actors by clicking on the Scene Editor background and dragging – a selection rectangle will appear, and all actors under the rectangle will be selected when you release the mouse.

•!To send data from the output of one module to the input of another, click the output port (the blue dot). A connection or *link* anchored to the output port will now track your mouse movements. Click on the input port (again, the blue dot) next to the input to which you want the data sent. When data flows through the link, its color will change from red to green. Note that video and sound outputs cannot be connected to number inputs or vice-versa.

• Read the section in the tutorials entitled "Understanding Value Scaling". Understanding this feature will allow you to get the most out of Isadora.

• To delete a link, click on it and choose **Edit > Clear** or press the Delete key.

• Point the mouse at a link that is carrying video and a small window will appear, displaying the video moving through that connection. This is quite useful when you

have a complicated video patch and you want to see the video as it moves from actor to actor.

• Contextual menus are available throughout the program. Control-click (MacOS) or right-click (Windows) to display a pop up menu with the currently available choices.

• To show help for an actor, or one if its inputs or outputs, control-click (MacOS) or the right click (Windows) to show a pop-up menu From that menu, choose “Actor Help…” to display help information for the actor, or “Actor Input Help…” or “Actor Output Help…” to show help for an input or output.

• To insert more scenes, click to the right of the last scene in the Scene List at the bottom of the window. When you see the blinking cursor, choose **Scenes > Insert Scene**. A new, empty scene will appear.

• To delete a scene, click on the scene and chose **Edit > Clear** or press the Delete key.

• To activate a different scene, click on it in the Scene List. The old scene will be deactivated and the new scene and its actors will be shown in the Scene Editor.

• You can jump from one scene to another using the Jump actor found in the Control Group section of the Toolbox.

Registration Procedure

Before you will be able to save your work in Isadora® you must register Isadora® on your computer. This section outlines the registration procedure.

Step 1: Download

You should download the latest demonstration version from the TroikaTronix web site. The demonstration version becomes fully enabled (i.e., allows you to save) after you register it. You can always find the latest version on the *Downloads* page at http://www.troikatronix.com/izzydownload.html.

Step 2: Purchase

You need to purchase a license from the TroikaTronix web site. Follow the instructions at http://www.troikatronix.com/izzypurchase.html to obtain your license. Each licensee is entitled to generate up to three registration codes per year. This takes into account purchasing a new computer, reformatting your hard drive, etc. Once you register Isadora on a computer it will work on that machine forever, except if you reformat your hard drive.

After your order has been processed, you will receive an email with the information required to register your copy of Isadora. Keep this email in a safe place, as you will need it to generate future registrations. The information in the email will look like this:

User Name: Isadora Duncan
Serial Number: ISM-99999
Password: lucky-meter
Registrations Remaining: 3

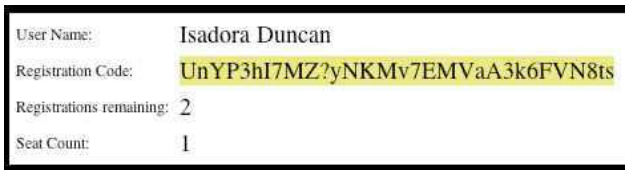
Step 3: Register

Isadora® Registration
To register Isadora on this computer, you will need the user name, password, and serial number given in the email you received after purchasing the program. Enter all information exactly as shown in the email – capitalization counts!
If you are connected to the Internet, enter the requested information below and click the "Generate via Web Page" button to create a registration code via your web browser.
User Name:
Isadora Duncan
Password:
lucky-meter
Serial Number:
ISM-99999
Machine ID:
808643E0
Generate Registration Code via Web Page
If your computer is not connected to the Internet, write down the Machine ID shown above and take it to a computer with an Internet connection. Use the web page shown below to generate a code.
http://www.troikatronix.com/macregister.html
After the registration code appears in your web browser, copy and paste it into the space below and click the "Register" button.
Paste
Cancel
Register

Follow these steps to register your copy of Isadora:

- Run your copy of Isadora by double-clicking its icon.
- Choose **Edit > Register**. The dialog box shown above will appear.
- Enter the User Name, Password, and Serial Number, exactly as you received it in the email from TroikaTronix. (Capitalization counts!)
- Click the “Generate Registration Code via Web Page”

Your browser will automatically open and generate a new registration code. The code will appear near the bottom of the page:



- Using the mouse, select the Registration code and choose **Edit > Copy.**
- Go back to Isadora, and paste the code into the field at the bottom of the Registration dialog, either by pressing Command-V (MacOS) or Control-V (Windows), or by clicking the **Paste** button.

After the registration code appears in your web browser, copy and paste it into the space below and click the "Register" button.
UnYP3hI7MZ?yNKMv7EMVaA3k6FVN8ts
Paste
Cancel
Register

- After you have correctly entered the registration code, the “Register” button will become enabled. Click it. Your copy of Isadora is now registered.

Tutorials

Preparing Your Computer

Download the Tutorials

Before you begin, you should download the tutorial files from the TroikaTronix web site. The address is

http://www.troikatronix.com/files/isadora-tutorials.sit (for MacOS Computers)

or

http://www.troikatronix.com/files/isadora-tutorials.zip (for Windows Computers)

After decompressing this document, you will have an Isadora Tutorials folder, with six Isadora documents and seven media files.

Basic System Requirements

Here are the basic system requirements needed to run Isadora:

Macintosh Requirements

- MacOS 9.0 or better
- 500 Mhz PowerPC G3 or better processor (G4 *strongly recommended*)
- 256 MB of RAM Minimum, 512 MB or more recommended

Windows Requirements

- Windows XP or better
- 1.5 MHz Pentium III Processor or better
- 256 MB of RAM Minimum, 512 MB or more recommended

Optional

- Second Video Monitor. Most desktop computers will require a second video-output card to be installed for them to be able to output video to a second monitor. Most contemporary laptops support a second video output as a standard feature. If your laptop does not have this feature built-in, then it is difficult to add it at a later time.
- Video Digitizing Card or Fire Wire Digital Video Input for live-video capture. Note that if you want to use your computer's Fire Wire input to bring live video into Isadora, you will need to have either a digital video camera with a Fire Wire output, or a analog video to Fire Wire converter such as the Sony DVMC-2 or Canopus DVAC-100.

- Under Windows, you will need a QuickTime compatible video digitizer driver. A free, basic digitizer called WinVDIG be found at

  http://www.vdig.com/WinVDIG/index.html

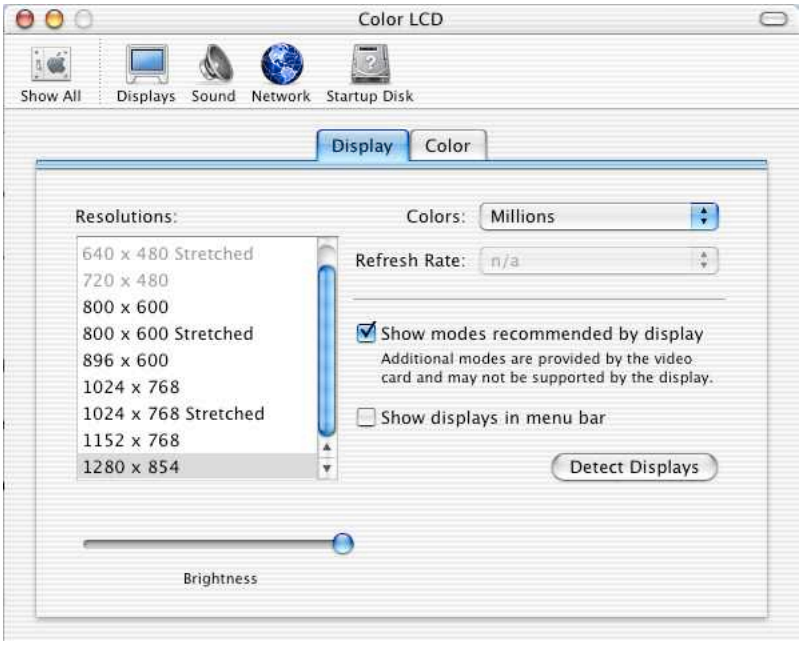
  Follow the installation instructions with one of these driver to install it on your system.
- MIDI Interface and MIDI Input/Output Drivers – required if you plan to use MIDI input and/or output.

Set Monitor Resolution & Color Depth

The resolution and color depth settings that you choose for the screen (or screens) to which Isadora will output video has noticeable effects on the speed with which that video will be rendered. You can find out more about this later in the manual, in the section labeled “Performance Issues” in the *Isadora Reference* section of this manual. 640 by 480 is always a good choice because it is often an even multiple of the size of the video you are processing.

MacOS X

On Mac OS X, you can adjust the resolution of your monitors using in the System Preferences. You can open the System Preferences on the by clicking in its icon in the dock. After the System Preferences window appears, click on the icon labeled “Displays”. On each monitor connected to your computer, you will see a window that looks like this:



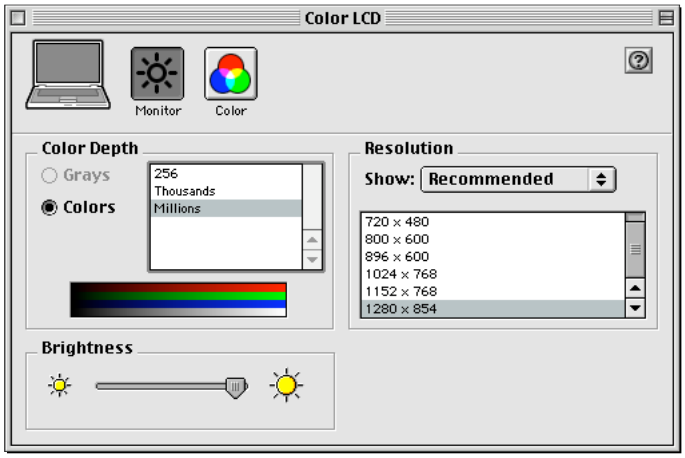
You can change a monitor’s resolution by clicking on the desired resolution as shown in the list on the left side of the window. On the main monitor, choose whatever resolution you find most comfortable when working.

If you have two monitors, we recommend that you set the resolution of the second monitor to 640 by 480 – this will give the fastest performance when Isadora renders video to that second monitor. It is possible that the 640x480 resolution may be grayed out on your system. Usually you can access this resolution by un-checking the box labeled “Show modes recommended for display” in the window shown on the Main display.

You can also select the Color Depth using the “Colors” popup men near the top right of the window. We recommend that you set the color depth to **Millions** for fastest performance.

MacOS 9.x

On Mac OS 9, you can adjust the resolution of your monitors using the Monitors Control Panel. (Choose **Apple Menu (** **)** **> Control Panels > Monitors**.) On each monitor connected to your computer, you will see a window that looks like this:

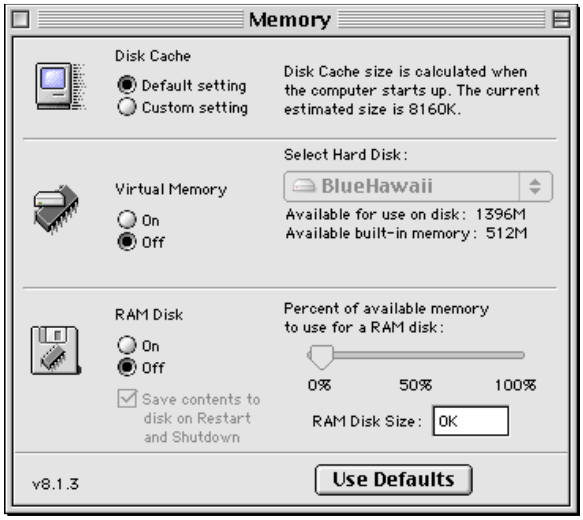


You can click on the change the monitor’s resolution by clicking on the desired resolution as shown in the list on the right side of the window. On the main monitor, choose whatever resolution you find most comfortable when working. If you have two monitors, we recommend that you set the resolution of the second monitor to 640 by 480 – this will give the fastest performance when Isadora renders video to that second monitor. You can also select the Color Depth on the left side of the window. If you set the color depth to **Millions**, Isadora will render a bit more slowly to the screen but the color fidelity will be superb. If you set the color depth to **Thousands**, speed will improve but color fidelity will suffer somewhat. It is not recommended that you choose **256**.

Virtual Memory (MacOS 9.x Only)

For the best real time performance, we recommend that you turn off virtual memory on your computer when running Isadora under the classic MacOS. To do this, choose **Apple Menu (** **)** **> Control Panels > Memory**. Under the Virtual Memory section, click the “Off” radio button if it is not already selected and close the

window. When you change the virtual memory setting, you will need to restart your computer for the change to take effect.



Installing MIDI Interface Hardware & Drivers

If you plan on using MIDI as a way of controlling Isadora, or if you need to send MIDI out of Isadora to control other programs, you will need a hardware MIDI interface and driver software. The sections below give general information on how to install the drivers for the various operating systems.

MacOS X

MIDI support is built into MacOS X. You will need to install OS X drivers for your particular MIDI interface before it will be recognized. These drivers are generally included on a CD-ROM that accompanies the interface.

Double-click the installer application and follow the instructions provided. You may need to restart your computer again after installing these drivers – the installer will ask you to do this if it is necessary. After installation is complete, plug your MIDI Interface into your computer using the supplied cable.

Once the drivers are installed and the MIDI interface is connected, its input and output ports should automatically show up in Isadora's MIDI Setup dialog. (See next section for information on setting up the MIDI Setup Dialog.)

MacOS 9

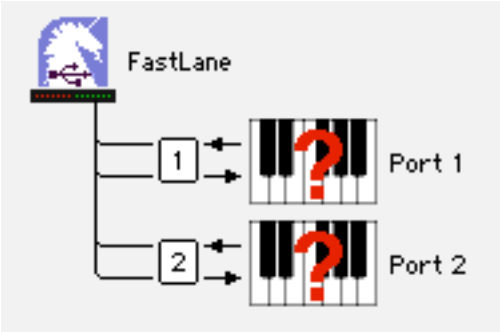
In addition to your hardware MIDI interface driver software called Opcode Music System (better known as OMS.) At the time of this writing, OMS can be downloaded at no charge from http://www.opcode.com. After downloading, double-click the OMS installer and follow the instructions. Once installation is complete, you will be required to restart your computer.

Then, you should install the drivers required for your MIDI hardware interface. (This generally comes on a CD-ROM that accompanies your hardware.) Double-

click the installer application and follow the instructions provided. You may need to restart your computer again after installing these drivers – the installer will ask you to do this if it is necessary. After installation is complete, plug your MIDI Interface into your computer using the supplied cable.

Now, you should double-click the **OMS Setup** application that was installed on your computer and follow the instructions when asked to create a new studio setup. OMS should find your hardware MIDI interface when it scans for MIDI devices.

Once you have created a basic studio setup, click on the icon for your hardware MIDI interface and choose the **Studio > Add Devices Per Port…** command to add ports that match those supported by your hardware MIDI interface. After you do, you should see something like this in the Studio Setup window:



For this example, we used the Mark of the Unicorn FastLane MIDI Interface. This interface has two MIDI inputs and two MIDI outputs, that's why there are two icons shown connected to the FastLane interface icon. (If your interface only has one MIDI input and output, only one icon will appear.)

The default names for these ports are Port 1 and Port 2. You can change these if you like by clicking on the name and typing a new name.

You can then save the Studio Setup document and quit OMS.

Once the drivers are installed, OMS is set up, and the MIDI interface is connected, its input and output ports should automatically show up in Isadora's MIDI Setup dialog. (See next section for information on setting up the MIDI Setup Dialog.)

Windows

MIDI support is built into Windows. You will need to install drivers for your MIDI interface before it will be recognized. These drivers are generally included on a CD-ROM that accompanies the interface.

Double-click the installer application and follow the instructions provided. (You may need to restart your computer again after installing these drivers – the installer will ask you to do this if it is necessary.) After installation is complete, plug your MIDI Interface into your computer using the supplied cable.

Once the drivers are installed and the MIDI interface is connected, its input and output ports should automatically show up in Isadora's MIDI Setup dialog. (See next section for information on setting up the MIDI Setup Dialog.)

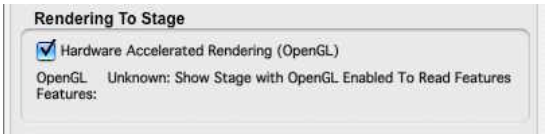
Setting Isadora Preferences

The first time you run Isadora, you should set up your preferences. To do this you must find your Isadora application and double click on it. Isadora will open up with a new file. From the menu along the top of your screen choose **Edit > Preferences…** to set up your preferences.

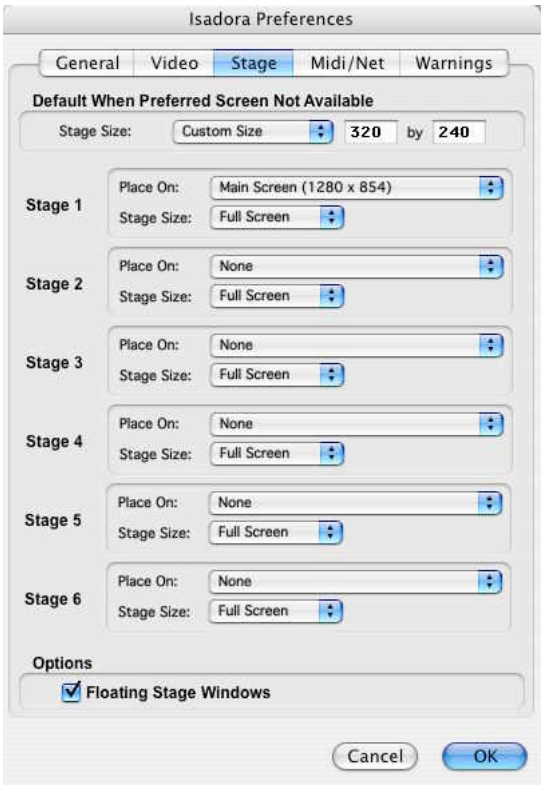
Isadora supports up to six video output channels, called *Stages*. The *Stage* section of the Preferences window allows you to set the screen (i.e., monitor output) on which a stage will appear when it is shown.

For now, set up the preferences as follows:

- Click the "Video" tab at the top of the window to change the Video settings.


Rendering To Stage
Hardware Accelerated Rendering (OpenGL)
OpenGL Features:
Unknown: Show Stage with OpenGL Enabled To Read Features

- Turn on the checkbox marked **Hardware Accelerated Rendering**. When this box is checked, video will be rendered to the stage using the hardware graphics accelerator built in to your computer. It also enables several new features new in v1.1. Enabling hardware rendering should provide better performance most recently built computers. If you have a somewhat older computer, and you find that you don't see any output on the stage, you may need to uncheck this box.
- Then, click the "Stage" tab at the top of the window to change the Stage settings.



- In the area marked **Default When Preferred Screen Not Available**, choose "Custom Size" from the popup menu labeled **Stage Size**, Two text edit boxes will appear to the right of this menu. These allow you to specify the stage window's dimensions in pixels (horizontal and vertical, respectively). Type "320" into the first one (the width), and "240" into the second (the height).
- Under the heading **Stage 1**, choose "Screen 2" in the popup menu labeled **Place On**. If you have a second monitor output on your computer, the resolution of the screen will be shown in the pop-up menu text (i.e., Screen 2 (640x480)"). If not, it will just say "Screen 2". Make sure that the popup labeled **Stage Size** in the Stage 1 section is set to "Full Screen."
- Under the heading **Stage 2**, **Stage 3**, **Stage 4**, **Stage 5**, and **Stage 6**, choose "None" in the popup menu labeled **Place On**.
- Click "OK" to confirm the new preference settings.

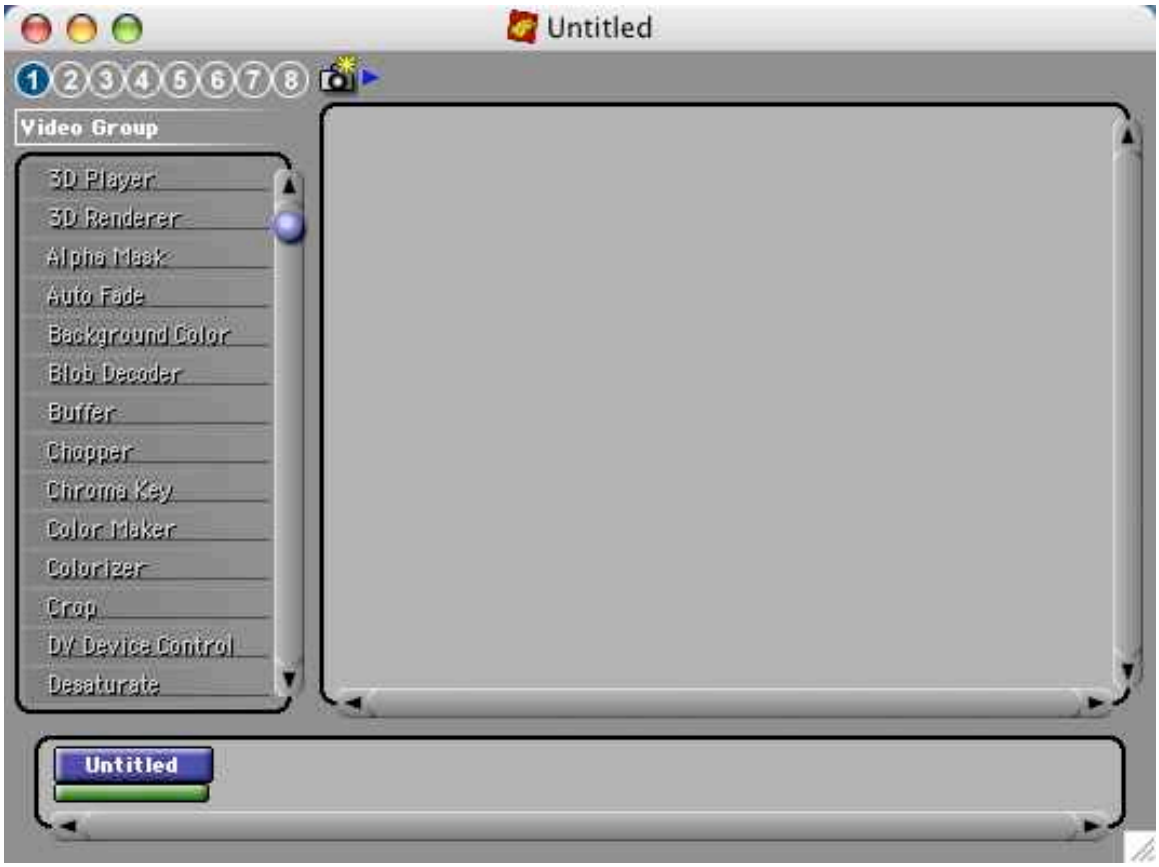
This setup will show one stage window on your second monitor output, if a second monitor output is available. If not, then a smaller window will appear on your main screen.

You can find out more about showing stages, setting them to occupy an entire screen, and other preference settings in the "Preferences" section of the *Isadora Reference* chapter of this manual.

Tutorial 1: Playing a Movie

Creating a New File

To create a new Isadora file, choose **File > New**. A new Isadora document that looks like this will appear:



There are four main areas to the Isadora document: The *Toolbox*, found along the left; the *Scenes List* along the bottom; the *Snapshots* area across the top-right, and the *Scene Editor*, which takes up the rest of the window. A new Isadora document will have one untitled Scene already inserted into the Scenes list at the bottom of the window. Note the green bar below that first Scene – this indicates that the Scene has a Control Panel. (We will discuss control panels in a later tutorial.)

Scenes are where you create the "program" that defines how the media will be manipulated and controlled when that scene is active. You may have numerous Scenes inside of one Isadora document, though, generally speaking, only one Scene is active at a time. (There is more about multiple scene activation in the Advanced Topics section of the manual.)

Creating Scenes

To insert a new scene into the Scene List:

- Click to the right of the last scene in the Scene List. If a scene is active, it will deactivate (go from blue to gray) and a blinking cursor will appear at the spot where you clicked. This indicates where the new scene will be inserted.
- Choose **Scenes > Insert Scene**.

A new scene called “Untitled-1” will appear where the blinking cursor was previously. You can see that it has been activated because the Scene Editor will be visible.

You can activate different scenes by clicking on that scene in the Scene List. To activate the first scene, simply click on it – you can try this now with the first scene in the list. It will highlight to indicate that it is active, and the other scene will deactivate. This will mean more when you have actually inserted some actors into the two scenes.

To rename your Untitled Scene choose **Scenes > Rename Scene** and type in your new scene name**.** You can find out more about cutting, copying, pasting and deleting scenes, in the “Scene List” section of the *Isadora Reference* chapter of this manual.

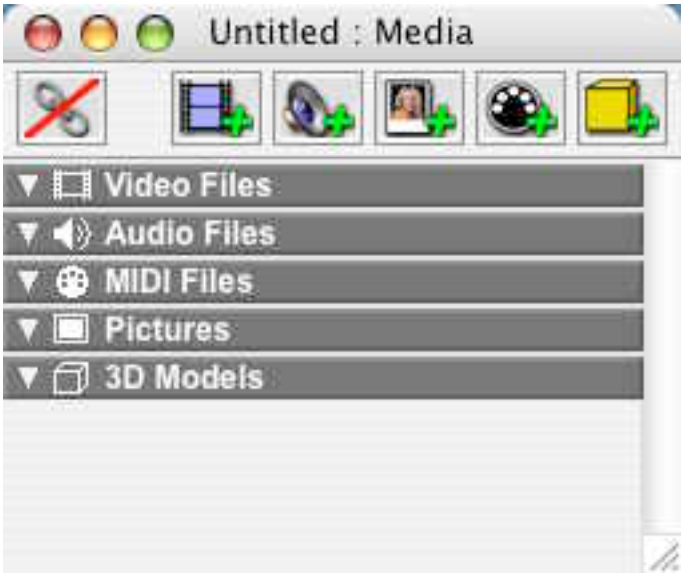
Importing Media

Isadora allows you to process both live and prerecorded images and sound. If you want to use prerecorded media, you will need to import it into Isadora.

Isadora can play and manipulate four types of files: Digital Video Files, Digital Audio Files (AIFF, WAVE or Sound Designer II), Pictures, Standard MIDI Files or 3D Object Files (3DS).

To import a media file into Isadora:

Choose **Windows > Show Media** to show the Media Window. It will look like this:



When you create a new Isadora document, it starts with five *bins*, one for each type of media file that can be loaded into the window. You can new bins using the buttons at the top of the window.

Choose **File > Import Media**. A file selection dialog will appear. Find the "dancer.mov" QuickTime movie in the "Isadora Tutorials" folder. The movie will be imported into Isadora and appear in the Media window as shown below.

If you like, you can select multiple items in the file selection dialog by holding down he Shift key as you select multiple items and then click the "Open" button. All of the files you have selected will be imported into Isadora and appear in the proper bin in the Media window.

Also note that you can add files by dragging them into the media window from the Finder (MacOS) or Explorer (Windows).

Note the number to the left of the movie's name. This number is important, as it is how you specify which media file to play or manipulate within an actor. Under each heading, the numbers start at one and count up from there. So, if you have three movies and three audio files in the Media window, the movies would be numbered 1,2, 3 and the Audio Files would be numbered 1, 2, and 3.

Using Isadora Actors

To define what a Scene does, you drag actors from the Toolbox on the left side of the window into the Scene Editor and connect them to each other in various ways. The Toolbox is where Isadora keeps all of the modules that are used to define a Scene. These modules can be divided into four basic types:

- Actors – Modules that act upon media or information
- Generators – Modules that create media or information
- Watchers – Modules that watch for information to come in from the outside world
- Senders – Modules that send information to the outside world

The modules contained in the Toolbox are divided into eight groups. You can see the names of the different groups by moving the mouse over the eight numbers at the top of the toolbox. They are:

1. Video Group
2. Audio Group
3. MIDI Group
4. Generator Group
5. Mouse & Keyboard Group
6. Calculation Group
7. Control Group
8. User Group

When you start up Isadora, Group 1 (Video Group) will always be selected. You can only drag modules into the Scene Editor from the active group.

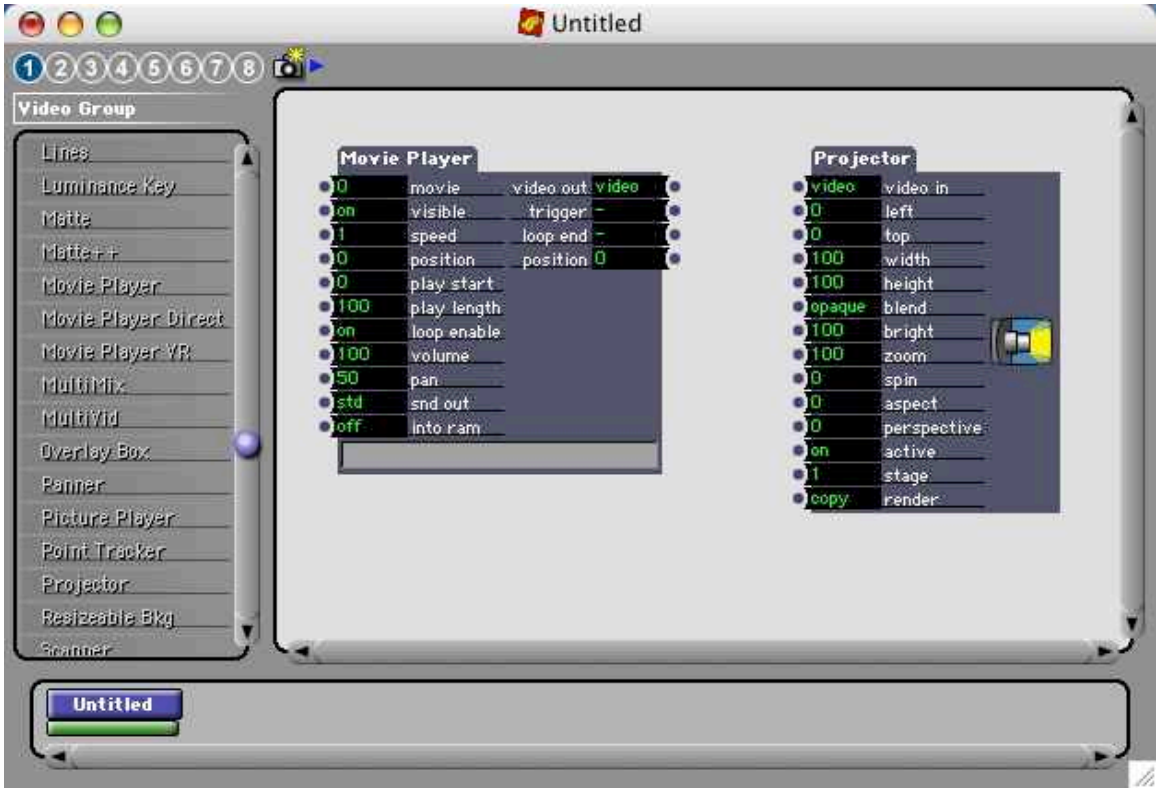
To make the modules under a different group available:

- Click on that group's number at the top of the Toolbox.

Let's create a scene that plays a movie. To do this:

- Click on the number 1 at the top of the Toolbox to ensure that the Video Group is selected.
- Click on the scene called "Untitled". The scene should become selected (if it wasn't already) and the empty Scene Editor should be visible in the top-right portion of the scene.
- Click on the module named "Movie Player." The cursor will change to a plus sign to indicate that you are about to add a new module.
- Move the mouse into the Scene Editor.
- Click a second time to deposit the Movie Player actor into the Scene Editor. The Movie Player actor will appear in the Scene Editor.

- Follow the same procedure with the Projector actor (if it is not visible then use the scroll bar to the right of the list of modules to scroll through the list of modules). Place it to the right of the Movie Player actor. Your document should now look something like this:



You need to have both of these modules to play a movie because the movie player does not send the video image it produces directly to the stage. Instead, you need to route its video output to one of the stages by connecting it to the Projector module. The relationship between the Movie Player and Projector actors is the same as that between a videotape recorder and a television: the former handles the playback of the video tape, the latter allows you to see those images it produces. You can't see the images on the television unless you connect it and the videotape player.

Note that both actors have dots next their input or output property values. These are the actor's input and output ports. Input ports are always on the left, output ports always on the right. You move information (video, audio, or numbers) through Isadora by linking the output ports of one module to the input ports of another. To be able to see the video we need to route the video data from the Movie Player to the Projector actor.

Let's complete our patch.

First, connect the "video out" output Movie Player actor to the "video in" input of the Projector actor. To do this:

- Click on dot to the right of video out output on the Movie Player actor. A red line will appear and follow the position of your mouse as you move it. (You don't

have to hold the mouse button down while you do this – a single click will suffice.)

- Move the mouse to the dot to the left of the video in port on the Projector actor. The red line will become thicker to let you know that you are inside the input port.
- While the red line is thick, click to complete the link. Note that at this point the link between the actors is red, indicating that no data is flowing through it.

Now we need to tell the Movie Player actor which movie to play. Remember, we imported the movie called "dancer.mov" into the media window previously and it was number "1" in the list.

- Click in the box to the left of the movie input in the Movie Player actor. The number will disappear, and the black box will become blue to let you know that you can type a new value.
- Type the number 1, and then press *enter*. Once you do this, you will see the name of the movie (or at least part of it) to the right of the number "1", e.g., "dancer.mov". That is the movie we previously imported into the Media Window. Also, the link between the Movie Player and Projector will turn green, indicating that data is flowing through it. Finally, note the thin yellow line moving across the green bar along the bottom of the Movie Player actor. This shows you which frame of the movie is playing currently.

Finally, show the stage:

- Choose **Windows > Show Stages**. The Stage window will appear. (If your screen goes black, it is probably because you forgot to set the Preferences as described previously. To hide the stage again, hit the shortcut key for Show Stages (**Command-G** on MacOS, **Control-G** on Windows). The stage will disappear and you will be able to see your document again. Go back to the section above entitled "Setting Isadora Preferences", follow the instructions there, and then try this step again.)

After showing the stage, you should be able to see the movie playing inside of the stage window. Congratulations, you've made your first Isadora scene.

Take note of a few things before you quit this lesson:

- When the movie gets to the end, it automatically jumps back to the beginning and continues playing from there. By default, the Movie Player actor loops movies in this way.
- As mentioned above, a link is red when no data is flowing through it, green when data is flowing through it. This color-coding helps you visualize when how data moves through an Isadora Scene.

Tutorial 2: Changing Actor Settings

As you can see, both the Movie Player and the Projector actors have a list of numbers and titles along both the left and right sides of the modules. The values along the left side are input properties –!they determine what the actor does when its

scene is activated or allow data to flow into the actor. The actor outputs information through the output properties along its right side.

There are two basic ways to change the setting of a property: either with the keyboard or the mouse. Let's start by changing some input property values in the Movie Player using the keyboard.

- Close any currently open Isadora documents. Then choose **File > Open** and locate the file called "Tutorial 2" in the "Isadora Tutorials" folder.
- On your system, it may be that Isadora won't automatically find the one media file in this document – dancer.mov. If so, a file selection dialog will appear that looks like this:

  The dialog shows you the name of the media file it is trying to locate in the title of the dialog box, as well in the text just below the file selector area of the window.

  To help Isadora locate the file, select the movie "dancer.mov" in the "Isadora Tutorials" folder and double-click it.

- Make sure that the stage is visible. If it is not, choose **Windows > Show Stages** to show the stage. You should see a movie of the dancer from Tutorial 1.
- Then, in the Movie Player actor, click inside the box to the left of the words play length (the property's title). The box will turn blue and the number will disappear to indicate that Isadora is waiting for you to type a value.
- Type the number "5" and press *enter*.

Look at the video output on the stage window. You will see the dancer "jitter" because we are now looping over a small portion of the movie. The bar at the bottom of the Movie Player gives a graphic representation of the new setting: the light green area is now a short portion at the left, while the rest of the bar is dark

green. The light green portion indicates what part of the movie is playing. In this case, we are playing the first 5% of the movie. Watch the yellow playback indicator – when it reaches the end of the light green area, it jumps back to the start of the movie, showing how the movie loops.

- Now, click on the play start property value (the black box.)
- Type "50" and press *enter*.

The Movie Player is still playing 5% of the movie, but instead of starting at the beginning, it is starting halfway through the movie, i.e., it starts playing at 50%, and when it gets to 55%, it jumps back to 50%, etc. Look at the bar at the bottom for a graphic indication of the portion of the movie that is playing.

You can also change values using the mouse. Currently the speed property value is set to "1" which means, play forward at normal speed.

- To adjust this property using the mouse, click the speed property value (the black box to the left of the property title) and, while holding the mouse button down, drag slowly towards the bottom of the screen. You will see the value get lower as you do.
- Continue dragging down until the speed says "0.5" and then release the mouse button.

The movie is now playing in slow motion, specifically, at 1/2 of its normal rate. You can also make the movie play backwards:

- Again click in the speed property value and, while holding the mouse button down, drag slowly towards the bottom of the screen until the value reads "-1.0". Release the mouse button. The movie is now playing at "normal" speed, but backwards instead of forwards.

Finally, you can make the movie play at twice its normal rate:

- Using the mouse, click in the speed property value and drag up until the value reads "2". Release the mouse button.

Another interesting property in the Movie Player is position. Do the following:

- Change play start back to 0
- Change play length to 25
- Change the speed to 0.0
- Using the mouse to change the value, click in the position property value and drag the mouse up and down. As you movie the mouse you will "scrub" the movie back and forth. It is a bit like a DJ scratching a record, but instead you are scratching video with the mouse movements.

In this last example, each time you change the position property to a new value, the movie jumps to the specified position within its play duration. The movie doesn't continue playing because its speed is set to 0 (i.e., still.)

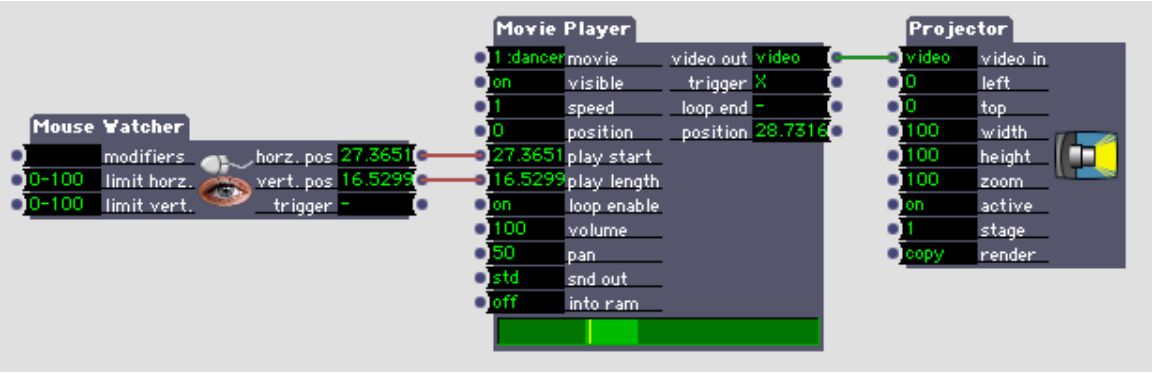
You can also try editing the other movie properties: try setting the loop enable property "off" to cause the movie to play only once without looping. Or, import a

movie with a sound track and or change the volume property to change its playback volume.

Tutorial 3: Interactive Control

In the previous tutorial we used the Movie Player and Projector actor's to play a movie on the stage, and you used the mouse and the keyboard to change how the movie played. In this tutorial we will build on this setup to allow you to interactively control movie playback with the mouse.

- Close any currently open Isadora documents. Then choose **File > Open** and locate the file called "Tutorial 3" in the "Isadora Tutorials" folder, located in the same folder as your Isadora application.
- Above the Toolbox, move the mouse over the number 5 – the prompt below your group numbers should say Mouse & Keyboard in yellow. Click the number 5 to show that group of actors.
- Drag the Mouse Watcher into the Scene Editor. After depositing it there, take a look at the horz pos. and vert pos. output property values. These outputs tell you the horizontal and vertical position of the mouse as a percentage of the total screen size. Move the mouse all the way to the top/left corner of the screen: the outputs will both read 0. Now move the mouse across the top of the screen. You'll see the horz pos. value gradually increase until it reads 100.Then move the mouse down along the right side of the screen. The vert pos. will gradually increase until it reads 100.
- Set the play length property to 5 by clicking on it and typing from the computer keyboard. Then, link the Mouse watcher's horz pos. output port to the Movie Player's play start input port. You can see how the horizontal mouse movements scrub through the movie as it's playing. Then connect vert pos. to the play length input port on the Movie Player. You'll remember from the previous tutorial that the Movie Player's play start and play length values are also expressed as a percentage, from 0 to 100 of the movie's total duration. Your patch should look something like this:



- Show the stage and experiment by moving the mouse around on the screen. Try moving the mouse so that it is all the way to the left of the screen, and nearly all

the way to the top. Take a look at the stage: the Movie Player actor should be looping on a small portion of the movie. Now gradually move the mouse across the screen to the right. The portion of the movie that is looping will change as you move. Look also at the indicator at the bottom of the movie player window to see how it changes as you move the mouse. It will give you a clear visual indication of what part of the movie you are playing.

This model of taking input from the outside world and linking it to an actor's input properties is the one on which all interactive programming in Isadora is based. Just remember that instead of the mouse position, it could be the computer keyboard, MIDI, or remote Network connection controlling the previously demonstrated variations of the play back of the movie. We'll illustrate these possibilities in later tutorials, but for now, try a couple of other interactive setups:

- Disconnect the links between the Mouse Watcher and Movie Player. You do this by clicking on the link to select it (the link changes to a brighter color to indicate that it is selected) and then choosing **Edit > Clear** or pressing the delete or backspace key. Note that you can select more than one link by shift clicking.
- Set the Movie Player's speed to 0. Set play start to 0, and play length to 100. Then connect the Mouse watcher's horz pos. to the Movie Player actor's position input. Move the mouse left and right to "scratch" the movie like a DJ would scratch a record.
- Now connect the vert pos. to the Projector actor's zoom input. You will be able to scratch the video by moving horizontally, and zoom the video by moving vertically.
- Disconnect all of the links except the one connecting the video out from the Movie Player to the video in on the Projector. Set the zoom input on the Projector to 100. Set the Movie Player actor's speed to "1" again. Set the Projector actor's width and height properties to 50. Then connect the horizontal and vertical mouse positions to the Projector actor's top and left properties. Move the mouse around to squeeze and stretch the video image on the stage.

You can also use the computer's keyboard to manipulate actors.

- Disconnect all of the links except the one connecting the video out from the Movie Player to the video in on the Projector. Set the Movie Player actor's speed to "1" again. Set the Projector actor's width and height properties back to 100.
- With the Mouse & Keyboard group selected in the Toolbox, click on the Key Table actor and drag it into the Scene Editor.
- Click on the num. keys property value, type the number 4, and press *enter*. The actor will "grow" taller as three more inputs are added.
- Click on the key 1 property value, type **'a'** (i.e., single-quote, the letter a, and another single-quote). Then, press the Tab key to move to the key 2 property value and type **'s'**. Repeat this process for key 3 and key 4, entering **'d'** and **'f'** respectively and finish by pressing *enter*.
- Now connect the key num. output to the Movie Player's position input.

- Try pressing the a, s, d, and f keys on your computer keyboard. (Make sure the Caps Lock key is off!) Each time you do, the value at the key num. output will change to indicate which of the four keys you pressed, 1 through 4. This causes the movie to jump between 0%, 33%, 66%, and 100% its total play length. (How does 1 to 4 become 0 to 100? The output value of the Key Table actor is automatically being scaled to match the range of the Movie Player's position input, which can vary between 0 and 100. More on how Isadora automatically scales values in a later tutorial.)

The key thing here is to see that all Isadora parameters can be manipulated in real time by sensors (yes, the mouse and keyboard are sensors!) in the real world.

Tutorial 4: Live Video Input

Isadora can just as easily process video from a live input as that from a prerecorded source. This tutorial shows you how to use live video with Isadora.

First, you must have capture hardware that allows Isadora to "see" the video coming into your computer. On contemporary Macintoshes the Fire Wire input is the most ubiquitous way to input video. (Fire Wire, aka iLink or IEEE1484, is also becoming common on Windows machines.) In addition, there are various capture boards, PC Cards (for laptops), USB video capture devices, etc. Any of these can be used with Isadora as long as you have installed drivers that allow them to be seen by QuickTime. On the Macintosh, this is pretty much a given. On Windows machines, it is may be somewhat more difficult to configure.

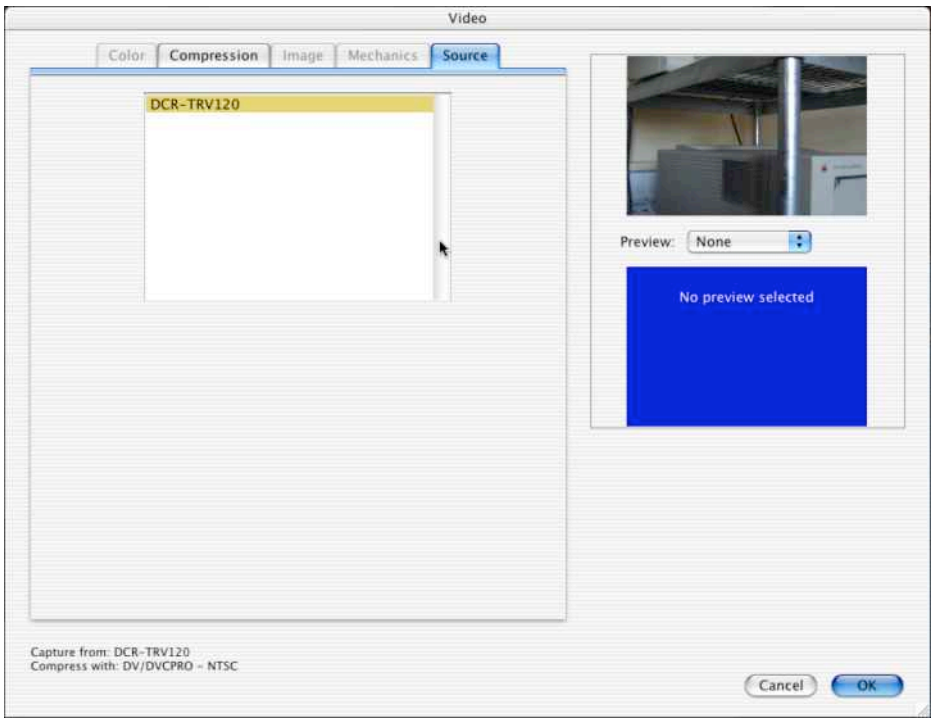
When using capture boards or other external video capture hardware, the installation procedure varies from vendor to vendor. Follow their instructions to install the video input hardware on your system.

Here's how to create a simple patch that will allow you to show live video on Isadora's stage.

- You should start by making sure that Isadora is not running. If it is, quit it before connecting your camera.
- First, connect your video camera or VCR to the video the video capture device on your computer. For computers with Fire Wire inputs, you would connect your digital video camera's Fire Wire output to the computer's Fire Wire input. Most other capture devices accept an analog video input. If this is the case, connect the analog output of your camera (often a yellow RCA phono plug) to the analog video input of your capture device.
- Now you need to enable video capture in Isadora – as it is not enabled by default. Turn your digital camera on to the "camera" setting (i.e., not VCR or Tape). Then choose **Input > Start Video Only Capture** to begin bringing live video into Isadora. If no video input can be found, an error message will be shown indicating that no video input is available.
- Choose **Input > Show Capture Preview** to show the Video Preview Window. You will see a copy of the live video signal coming into the computer. Close the

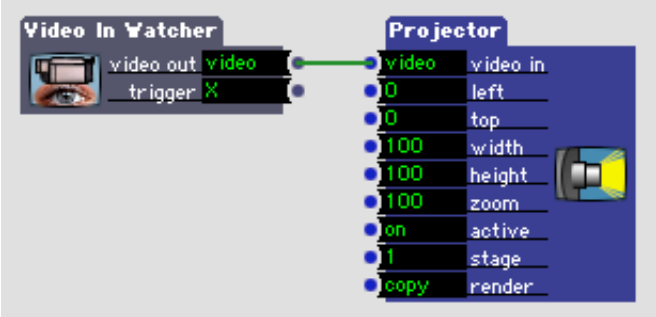
window when you have verified that Isadora is seeing the input from your video camera. (It is important to close the Video Capture window after you've verified that you have live input, as leaving it open will use some of your CPU power to display the preview.)

- If you don't see live video in the Video Preview Window, Isadora is not seeing your camera. Look the Capture menu – is the item "Video Input Settings" unavailable (i.e., gray)? If so, then Isadora is not seeing your camera. Ensure that 1) your camera is turned on, 2) that you have installed the drivers for your external video capture device or internal video capture card, 3) the cable between to your camera is securely attached. Then choose **Input > Stop Video/Audio Input**, and then **Input > Start Video Only Capture** to try again.
- If the "Video Input Settings" item is available, but you don't see video in the Preview Window, then you may need to choose a camera in the Video Settings Dialog. Choose **Input > Video Input Settings**. You will see a window like this:



Click on the tab labeled "Source". There you can select the video camera that Isadora will use for live input. Click on the video camera you want to use – you should see a preview at the top right of the window. When you do, click the OK button.

- Now that you've verified you have live input coming into Isadora, create a new file by choosing **File > New.** Drag the Video In Watcher and Projector actors from the Video Group, into the Scene Editor. Then connect the video out output of the Video In Watcher to the video in input of the Projector actor. You're patch should look something like this:



- The link between the modules should be green, indicating that video is flowing from one to the other. Now, choose **Windows > Show Stages** to show the stage window. You should see the video from your camera or other video source on the stage.

In subsequent tutorials, we will use a movie as a video source because it is something that every Isadora user will be able to try. Just remember that "video is video is video" in Isadora regardless of its source – you can try using live input instead of prerecorded video in any tutorials where it seems appropriate or interesting.

Tutorial 5: Real Time Video Processing

Isadora offers a number of video processing actors that can manipulate a video image in real time. These can be found in the Toolbox if you choose the Video Group by clicking the number 1 in the Toolbox.

While the function of the video processing actors varies, the basic concept is the same: video comes into the actor, it manipulates the video image based on parameters that you set, and sends the result to its video output. Most video processing actors have just one video input, though some may have two or even three video sources. We'll focus on the single source actors in this tutorial.

We'll start with a simple setup that should illustrate the basic concept.

- As you did in Tutorial 1, insert the Movie Player and Projector actors into the Scene Editor window, and import the "dancer.mov" file in the "Isadora Tutorials" folder (located in the same folder as your Isadora application) into the Media Window.
- Now, click on the Colorizer actor in the Toolbox and drag it into the Scene Editor. Link the video out port of the Movie Player actor to video in port of the Colorizer actor. Then, connect the video out of the Colorizer actor to the video in of the Projector actor.
- Choose **Windows > Show Stages** to show the stage.
- You should see the video image as you did in Tutorial 1. But now, click on the Colorizer's red property value and change the setting to –50. The image will change color. Try other values for the green and blue properties. You can also

click, hold down the mouse and move it up or down to scroll through the values of these properties.

What's happening? Well, the red, green, and blue properties control the intensity of the red, green and blue pixels of the video image. Setting these properties to a negative value reduces the intensity of that color by the specified percentage, while setting them to positive values increases them by the specified percentage. If you were to set the green and blue values to –100, all of the green and blue would be removed from the image resulting in a red monochromatic image.

Let's try another actor.

- Select the Colorizer actor by clicking on it, and then delete it by choosing **Edit > Clear** or by pressing the delete or backspace keys.
- Now, click on the Dots actor in the Toolbox and drag it out to the Scene Editor. Connect its video inputs and outputs as you did previously with the Colorizer actor.
- The video image will look something like a picture printed in a newspaper – a series of dots that vary in size to represent the brightness of the image.
- Try experimenting with the dot size input property. Larger values produce larger dots. By the time you get to 25% or so, the image becomes fairly abstract.
- You can also change the mode property from "circle" to "square". The latter produces squares of varying sizes instead of circles.

There are several more actors that manipulate video. One quick way of seeing what the video processing actors can do is to open the "Isadora Examples.izz" file located in the "Isadora Examples" folder that was installed with your copy of Isadora. But, the best thing to do if you really want to understand these modules to create simple patches of your own. Don't forget that all of the input property values can be manipulated in real time – connect the Mouse Watcher's outputs to some of the your filter's inputs and experiment.

Below is a brief description of the single input video processing actors included with the Isadora, along with a description of what they do so that you can get started.

- **Colorizer** – Individual manipulation of the intensity of the red, green, and blue components of the source video image.
- **Desaturate** – Allows you to incrementally remove the color information from the source video.
- **Difference** – Compares the brightness of the current frame of video with the previous frame. The greater the difference in brightness between the two frames is, the brighter the resulting video. Can produce lovely, ghosting effects.
- **Dither** – Allows you to make grainier in various ways.
- **Dots** – Manipulates the incoming video so that it resembles a photograph printed in a newspaper. The dots vary in size to represent the brightness of the source image. You can vary the size of the dots from quite small to huge.
- **Flip** – Allows you to flip the video image horizontally, vertically, or both.

- **Freeze** – Allows you to freeze the incoming video stream.
- **Gaussian Blur** – Blurs the incoming video stream. Be cautious with the size parameter – values above 8 can cause Isadora to run very slowly, sometimes to the point where you might think that it has crashed.
- **HSL Adjust** – Adjusts the hue, saturation, and/or luminance (brightness) of the video image.
- **MultiVid** – Produces numerous copies of the source video – you can select the number of copies across and down independently.
- **Panner**– Allows you to pan up and down or left and right within the source vide stream. It does this by defining an area that is a subset of the source video, and then moving that area around. The actor gives visual feedback of what portion of the source video you are seeing.
- **Shimmer** – Produces dust like trails of pixels on moving imagery.
- **Slit Scan** – Copies a single line from the source image and scrolls that out, either horizontally or vertically. Named after the technique invented by Douglas Trumbull for the final sequence of *2001: A Space Odyssey*. Works best with slowing moving source imagery.
- **Spinner** – Allows you to rotate and zoom the source image.
- **The Edge** – Edge detection algorithm makes a highly digital look on high-contrast video imagery.
- **Video Delay** – Delays the incoming video image by passing it through a number of buffers, bucket-brigade style. Useful in a number of scenarios, but you can start by trying to mix the original and delayed video using the Video Mixer.
- **Video Fader** – Allows you to fade between the source video image and a solid color background.
- **Video Inverter** – The default behavior of this actor is to invert the video image, so that it looks like a photographic negative. For wilder results, change the "invert color" by using the color picker that appears when you clicking its 'color' input's value box (which shows as a little block of color.)
- **Warp** – As each frame of video comes in, this actor copies one line to the destination, moving down one line each time. Works best with a stationary background and a slowly moving object in the foreground. (Try pointing a camera at your face and moving it slowly.)
- **Zoomer** – Allows you to zoom in or out on the source video stream, with the additional capability of dimming the image as it passes through the filter. This can be especially useful with the Luminance Keyer (more on that actor later) to create beautiful feedback effects.

The most important thing that you can do is to experiment wildly. Our experience with any software is that the most interesting things occur when you attempt to misuse it. We encourage you to do the same with Isadora.

Tutorial 6: Sound

Isadora allows you to play and manipulate digital audio files, though in a somewhat more limited fashion than video. Currently there are two ways to play sound: from a QuickTime movie or from a digital audio file (AIFF, WAVE, or Sound Designer II formats.)

Let's start by importing some media

- Create a new Isadora document. Choose **File > Import Media**. From the "Isadora Tutorials" folder import the files called "voice1.aif", "chords.aif" and "thunder.mov". Note that the first two are digital audio files in the AIFF format, while the second is a QuickTime movie that has audio only– no video. (You can identify a "sound-only" QuickTime movie in the Media Window because a speaker icon will replace what would normally be a thumbnail image.)

First we'll work with the QuickTime movie audio.

- Select the Video Group in the Toolbox by clicking on the number "1" above the Toolbox. Drag the Movie Player actor into the Scene Editor.
- Set the movie input property to 1 so that the Movie Player will play the "thunder.mov" you imported above. You should immediately hear the sound begin to play. Note that you don't have to connect the Video Player to any other modules to hear the sound play. Unlike video, sound within a movie is sent directly to your computer's sound output and doesn't need a Projector actor for you to hear it.
- Select group 5, the "Mouse & Keyboard Group," in the Toolbox and drag the Mouse Watcher actor into the Scene Editor. Connect the horz pos. and vert pos. to the pan and volume inputs of the Movie Player actor. After doing so, move the mouse around on the screen. When the mouse is towards the top, the sound is soft, towards the bottom it is louder. Moving the mouse left and right will pan the sound to the left and right audio outputs on your computer. (You will only be able to hear the sound panning left and right if you have stereo speakers built-in or otherwise attached to your computer's audio output. Try some headphones if you'd really like to hear the effect.)
- You can also change the play start and play length parameters to play a portion of the sound. Set the play start to 10 and the play length to 5. You will hear a short loop of the sound. In fact, all of the movie player properties will work in the same way as when playing a video QuickTime movie.
- Turn off the Movie Player for now by setting is visible property to off.

Now, let's try the playing the AIFF file.

- Click on the "2" above the Toolbox to display the actors in the Audio Group. Drag the Sound Player actor into the Scene Editor and set its sound input property to play the "voice1.aif" file – the number will be 1 or 2, depending on which number was given to the file when you imported it. Take a look in the Media Window to be sure.

- The sound does not immediately start playing like the Movie Player. That's because you need to trigger its restart input for it to begin playing. Do that now by clicking in the restart input's value box with the mouse. (Note that this is a trigger input, indicated by the dash. You can't edit the value, but you can send a trigger when you click in the value edit box.) You should hear the sound of a solo voice singing a short phrase. Like the Movie Player actor, the Sound Player has a progress bar along the bottom that shows you how much of the sound is playing, and a yellow indicator line showing the part of the sound playing now.
- We can make a simple sampler by adding a watcher to look for keys to be pressed on the computer keyboard. Select the "Mouse & Keyboard Group" by clicking on the number 5 above the Toolbox. Drag the Keyboard Watcher actor into the Scene Editor. This actor allows you to trigger other actors when a key on the computer keyboard is pressed.
- Click on the key range input value and type single-quote, the letter a, and then another single quote, and press *enter*. The key range value box should read **'a'**. This causes the Key Watcher to look only for the key 'a'. (Note that it will not see 'A', or a capital a – just a small letter a.) Each time you press 'a' on your computer keyboard, the Keyboard Watcher sends the letter 'a' out of the key output. Connecting the key output to the restart input of the Sound Player so that you can trigger the sound each time you press 'a'.
- So now, press the letter "a" on your computer keyboard. Make sure your Caps Lock key is off so you're not typing a capital "A". When you type the letter, you should hear the sound begin to play. If you press the letter "a" again, the sound will start playing from the beginning. If you don't press 'a' again, the sound will play to the end and stop.
- Note that the sound stops playing when it gets to the end. This is because the loop enable property is turned off. If you change the loop enable property to "on" and press the letter "a" again, the sound will play continuously.

So, what's the difference between the Sound Player and Movie Player? The most important distinction is that Movie Player plays its sounds from your hard drive, while Sound Player loads all of the sound data into your computer's RAM (Random Access Memory – much faster than your disk) when you tell it to play. This means that Sound Player can make seamless loops, start up instantly, and in general be more responsive than Movie Player when manipulating the play start and play length properties. The downside is that long sound files can consume much of your available RAM. (FYI: CD Quality Stereo Audio takes up about 10 megabytes per minute.)

Generally, if you are going to play a music track that is several minutes long, and you don't need to manipulate anything besides the volume and pan, you should convert your sound to a QuickTime movie. If, however, you want to instantly trigger short samples, or you need to manipulate those sounds using the play start/play lengths settings, or other settings available only within the Sound Player, then you should import your sounds as AIFF, wave or Sound Designer II files.

The properties that the Sound Player shares with the Movie Player, namely speed, volume, pan, play start, play length, and loop enable, work in exactly the same way for both actors. Sound Player includes two other properties that we will explore presently: play channel and crossfade.

- To try out the crossfade property, do the following: in the Sound Player actor, turn loop enable on, set play length to 5. Then connect the Mouse Watcher's horz pos. output to the Sound Player's play start input. Press the letter 'a' on your keyboard to start the sound. Now, as you move the mouse left and right, the portion of the sound that will play moves through the sound file.
- If you leave the mouse still and listen to the sound, you'll notice that you often will get a noticeable click when you reach the end of the play segment and Sound Player starts playing from the beginning again. Now set the crossfade property to 5000. This value is specified in samples, so 5000 is about 1/10 of a second for CD quality sound sampled at 44100 samples per second. The click should either be gone or much less noticeable. The higher the number, the longer the crossfade.

To begin our final experiment with Sound Channels, set the loop enable property of the Sound Player to off so that the sound stops playing. Then disconnect the Mouse Watcher, and restore the play start/play length values to 0 and 100 respectively. Then:

- Highlight both the Keyboard Watcher and Sound Player by shift clicking on them. The choose **Edit > Copy** and finally **Edit > Paste**. Drag the copied actors so that they don't overlap the originals.
- Working now with the copied actors, set the sound input property of the Sound Player so that it will play "chords.aif". Then, change the key range input property to **'b'**.
- Press the letters 'a' and then 'b' on your computer keyboard. Each time you do, 'a' should trigger the first Sound Player, and 'b' should trigger the second. Again, this is a bit like a mini-sampler in that you can trigger short portions of each sound.
- Now, press the letter 'a', and before the first sound is done playing, press the letter 'b'. Note that the first sound stops playing, and the second one starts.

Why does one sound interrupt the other? It's because both of the sounds are set to play on the same *Sound Channel*. Look at the Play Channel input of the two Sound Player actors – both are set to 1. Because a Sound Channel can play only one sound at a time, when a second one starts to play, it interrupts the first. You can, however, get both sounds to play by setting them to different sound channels.

Set the play channel of the second Sound Player to 2. Repeat the experiment above, pressing the letter 'a' followed quickly by letter 'b'. Now you will hear both sounds playing at the same time.

Being able to interrupt a sound that is currently playing and being able to play two sounds simultaneously are both useful, depending on what you are trying to do. Just know that if you have a sound that is cutting out unexpectedly, it's probably because you are playing two sounds on the same Sound Channel.

Tutorial 7: Using Scenes

Scenes are a powerful feature of Isadora. They allow you to create several complicated setups and instantly switch between them, either by manually clicking on the scenes or by using triggers from the outside world. This is useful when you are creating pieces with multiple sections that have different interactive setups. In this tutorial we will illustrate several methods of working with Scenes.

- Close any currently open Isadora documents. Then choose **File > Open** and locate the file called "Tutorial 7" in the "Isadora Tutorials" folder, located in the same folder as your Isadora application.
- Choose **Windows > Show Stages** so that the stage is visible.
- In the Scene List you will see three scenes, label "one", "two" and "three". None of them are active because the default behavior is to start with all scenes deactivated when opening a file. Activate the scene labeled "one" by clicking on it.
- After you activate the first scene, you will see its actors appear in the Scene Editor. You should also see a movie being played in the Stage window.
- Press the space bar. You will see that scene "one" is deactivated, and scene "two" becomes active, and that the movie appearing in the Stage window changes.
- Press the space bar again. Now scene "two" is deactivated and scene "three" is activated. Again the movie shown in the Stage changes.
- Press the space bar one final time. Scene "three" is deactivated and scene "one" becomes active again.

How does this work? Take a look at the actors in scene "one". You will see a Movie Player connected to a Projector Actor. Below that, you will see a Keyboard Watcher and a new actor we have not yet used called Jump.

The Jump actor has three input properties. The mode works in tandem with the jump to input to determine which Scene will be activated when the jump is triggered. When a value arrives at the trigger input, the current scene is deactivated and the scene specified by the mode and jump to properties is activated.

If mode is set to relative and the jump to property is set to "+1", then the Jump actor will activate the next scene when triggered. If jump to is set to "-1", then Jump will activate the previous scene. "+2" would advance two scenes; "-2" would go back two scenes, etc. Relative jumps are useful when you want to be able to cut and paste a group of scenes that work together, and have their jumps still work properly.

If mode is set to "absolute", then the jump to property gives the number of the scene to jump to, where the first scene in the Isadora document would be "1", the second scene would be "2", etc. These jumps are generally less useful because cutting and pasting scenes would cause the absolute jumps to activate the wrong scene. However, there are situations that are useful, for instance, when you always want to jump to the first scene in the document.

As mentioned above, it is possible to cut, copy and paste, and rename scenes. Here are some quick examples of how to do this.

- Select scene “two” by clicking on it, and then choose **Edit > Cut**. Scene “two” will disappear from the scene list, and you will be left with a blinking insertion point between scenes “one” and “three”. Note that no scene is currently active, as both “one” and “three” are not highlighted (i.e., gray).
- Click the mouse to the left of scene “one”. The insertion point will be now be blinking to the left of scene “one”.
- Choose **Edit > Paste**. Scene “two” will appear where the insertion point was previously, and the other two scenes will move to the right.
- Click the mouse in between scenes “two” and “one”. Choose **Edit > Paste** again. You will now have another copy of scene “two”.
- With the copy of scene “two” still selected, choose **Scenes > Rename Scene**. The name “two” will turn into a text edit box. Type “four” into this scene and press *enter*.
- Activate scene “two” (the first scene) by clicking on it. Now press the space bar three times. Each time you do, the next scene in the list will be activated, ending up with scene “three”. Press the space bar again. Note that scene “four” becomes active, because scene “three” jumps backwards two scenes. Using only the space bar, you wouldn’t be able to get back to the first scene, which is called “two”. The only way to get there would be to click on it with the mouse.

You can select a group of scenes by clicking on the first one in the group, and then shift clicking on the last one in the group. Let’s fix the order of our scenes (so they go from “one” to “four”) and so that we can go through all of them using only the space bar.

- Click on scene “three”. Choose **Edit > Cut**. Click in between scenes “two” and “four” to show the insertion point there. Choose **Edit > Paste**.
- Now, click on scene “two”. Then, shift-click on scene “four”. This will select scenes “two” through “four”. Chose **Edit > Cut**.
- Click to the right of the only remaining scene, labeled “one”. The blinking cursor will be to the right of scene “one”. Choose **Edit > Paste**. Our scenes are now in order. Now we have to fix the Jump actors.
- Click on scene “three”. Click in the value box for the Jump actor’s jump to property, type the number 1, and press *enter*. Now scene “three” will jump to scene four when you press the space bar.
- Finally, click on scene “four”. Set the Jump actor’s jump to property to –3. This will jump backwards three scenes, which means we’ll end up at scene “one”.
- Now, press the space bar repeatedly. You’ll see that you are now able to loop through all the scenes.

Remember, we’re using the Keyboard Watcher as an easy way to illustrate how input from the outside world can be used to move from scene to scene. If you are interested in trying out an example that uses MIDI Note On messages to move from scene to scene, try the tutorial file “Tutorial 7 (Midi)”. If you’d like to try out this

file, quit Isadora, make that your MIDI Drivers are installed and that your MIDI interface is plugged in. Then start Isadora again and load "Tutorial 7 (Midi)". Set up your MIDI Input Ports by choosing **Windows > MIDI Setup**. (See the tutorial on MIDI for more help.) If you connect a MIDI keyboard to your MIDI interface and press keys on the keyboard, the Note On messages will do what the space bar did in the example above.

As a final example, we'll set up a document that automatically moves from one scene to another, without any user or performer intervention, as this is often useful for self-running museum installations.

- Close any currently open Isadora documents by repeatedly choosing **File > Close**. Then choose **File > New**. As usual, you begin with one scene called "Untitled."
- Choose the "Control Group" by clicking on the number 7 above the Toolbox. Drag a Jump actor into the Scene Editor.
- Choose the "Generator Group" by clicking on the number 4. Drag the actor called Pulse Generator into the Scene Editor. This actor will send a trigger at a regular interval. It has four input properties and one output property. The freq input allows you to set the frequency of the pulses in pulses per second; the run property allows you to allow the pulse generator to pause by setting its value to off; the reset input allows you to start the timing cycle over again. We'll only be modifying the freq input here, which you should set to 0.1 Hz. This means that the trigger output will pulse once every ten seconds.
- Connect the trigger output of the Pulse Generator to the trigger input of the Jump operator. At this point, even if the Pulse Generator sends a trigger, nothing will happen because there is only one scene.
- Select the Pulse Generator and Jump actors, and choose **Edit > Copy**. In the Scene List, click to the right of the one existing scene, and then choose **Scenes > Insert Scene**. Click on the Scene Editor to activate it, and then choose **Edit > Paste** to paste the two actors into the scene.
- Finally, change the jump to property of the Jump Actor to –1 and then wait. Then next time the Pulse Generator sends a trigger, you will jump to the first scene. If you then wait another ten seconds, you will jump to the second scene. This loop will continue indefinitely.

Of course, we didn't put any actors in these scenes that show movies or otherwise manipulate media. But the principal of how to automate the jump process would be the same regardless of the contents of the Scenes.

Tutorial 8: Fine Tuning Links and Actors

This chapter is vaguely mathematical because of the subject matter. Nevertheless, for those who dislike things mathematical, I strongly encourage you to take the time to understand this tutorial because understanding how property values work together that you can get the most out of Isadora.

Understanding Property Types

Before we talk about scaling values between inputs and outputs, we need to spend a moment talking about property *types*. We've mentioned some of them in passing in the previous tutorials: triggers, numbers, video, etc. Basically, each property is of one of the following types:

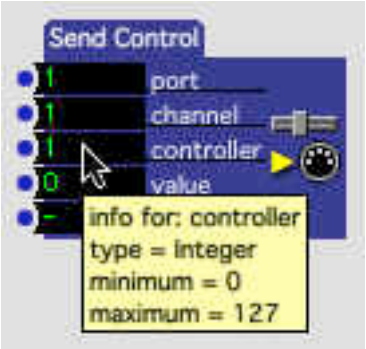
Integer	Number, without Decimal Points
Float	Number, with Decimal Points
Boolean	Number, only 0 or 1 (often displayed as off or on)
Range	A pair of integers, specifying a range of values
Trigger	A Boolean, but specifically looking for a "pulse"
Video	A video stream
Sound	An audio stream

All of the numeric types can be connected to one another, and will be scaled and converted (if needed). Video, however, can only be connected to video, and sound only connected to sound.

When you link different numeric types, the values may be converted. For instance, sending a Float value of 1.5 to an Integer input will yield a 1, because Integers don't allow numbers after the decimal point. (Note: the part after the decimal is simply discarded – values are never rounded up or down.) If you send an Integer value of 5 to a Range value, the Range will be set to 5-5 (i.e., from 5 to 5.) Hopefully these conversions are self-evident, except for the Trigger type, which constitutes a bit of a special case.

Triggers are numeric values (essentially 0 and 1, displayed as a dash or an X) but respond to incoming values in a special way. Whenever any new value arrives at a trigger input, the trigger "fires". You could illustrate this by linking horz pos. output of the Mouse Watcher to another actor's trigger input. Every time you move the mouse, new values are sent out of the horz pos. output and the trigger input to which it is connected will fire.

You can easily find out the type of a property. Just move the mouse cursor over the property's value edit box and then don't move it for a moment. An information box will appear, that shows you the property's name, type, and minimum and maximum values. It looks something like this:



Understanding Value Scaling

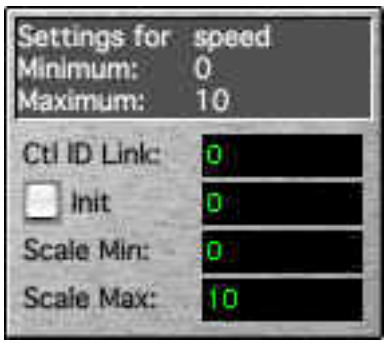
When connecting two numeric properties whose ranges of values are the same, you don't need to think too much about what happens to the values as they pass through the link: when a value is sent out of the output, that same value appears at the input to which it is connected. Even when both properties don't vary between 0 and 100, Isadora behaves in a consistent way by scaling the range of output values to match the range of inputs values. For example, when an output that varies between 0 and 127 (e.g., a MIDI value) is connected to an input that varies between 0 and 100, Isadora will scale the values proportionally so that as the output goes from 0 to 127, the input will go from 0 to 100.

Isadora's default behavior works great when you want an input property to vary over its entire range. But what if you want a finer degree of control over an effect, so that a value will vary between 20 and 40 instead of 0 to 100? Or if you need an input value to go down when the output value driving it goes up? This tutorial shows you how to accomplish this.

- Close any currently open Isadora documents. Then choose **File > Open** and locate the file called "Tutorial 8" in the "Isadora Tutorials" folder, located in the same folder as your Isadora application.
- This document has three scenes. Click on the Scene called "Tutorial 8". In it you will find a Sound Player actor, and a Mouse Watcher with its horz pos. output connected to the speed input of the Sound Player. Note that the sound started playing as sound as you clicked on the Scene, even though a Sound Player normally doesn't start playing unless you trigger its restart input. In this scene, we added an "Enter Scene Trigger" actor to start the sound. The Enter Scene Trigger sends a trigger whenever the Scene it is in is activated. Thus, activating the Scene starts the sound automatically.
- Now, move the mouse left and right. You will hear the sound go from a low pitch to a very high pitch, as its playback speed varies from 0 to 10 times normal speed. Note that Isadora is already scaling the values: as the Mouse Watcher's horz pos. varies between 0 and 100, the Sound Player's speed input ranges between 0 and 10. This is Isadora's default behavior when you link an input to an output, namely, scale the output value to match the input value.

This particular sound, the recording of the singer we used in Tutorial 6, seems a bit comical when playing at 10 times normal speed. Let's limit the range of speed so that it goes from 0.5 to 1.

- Click on the word speed in the Sound Player. An inspector window appear:



At the top is the name of the input or output along with the absolute minimum and maximum values allowed for this property. Below are four value edit boxes: **Ctl Link**, **Init**, **Scale Min.** and **Scale Max**.

By changing Scale Min and Scale Max, you can change the minimum and maximum values of the input, and thus change the way Isadora scales the values.

Note that these fields work like any value edit box: you can use the mouse to scroll up or down through the values, or click in the box, type a new value and press *enter*.

- Click in the value edit box next to "Scale Min.", type 0.5, and press *enter*. Now enter 1.0 into the Scale Max. value edit box.
- Move the mouse left and right again. You see (and hear) that, as the horz pos. output of the Mouse Watcher varies between 0 and 100, the speed of the sound will go between 0.5 and 1.0.

It is important to know that Scale Min. doesn't have to be less than Scale Max. In fact, you can "invert" the scaling by setting the number in Scale Min to a higher value than Scale Max. Try this:

- Again, click on the word speed in the Sound Player. Now enter 1.0 in the Scale Min value edit box, and 0.5 into Scale Max.
- Move the mouse from the left side of the screen to the right. Now, the playback speed of the sound goes from 1.0 to 0.5 as you move from left to right. You've inverted the behavior of the mouse movement.

Initializing Property Values

Finally, we should take a moment here to note the "Init" checkbox and the value edit box that accompanies it. When you need to make sure that a property is preset to a specific value when its Scene is activated, check the "Init" checkbox and enter the desired value into the value edit box to its right.

Let's create an example that illustrates why this feature is important.

- Click on the Scene called "Initializing" in the Isadora file "Tutorial 8" you opened above. Inside is an Envelope Generator that will ramp from 0 to 100 over a period of two seconds. Its output is connected to the volume input of a Sound Player. There is also a Keyboard Watcher looking for the space bar – it will trigger a

Jump actor to take us to the next Scene. Note that, though the sound is playing, the current volume of the Sound Player is 0 so you hear nothing.

- Now, click in the value edit box next to the trigger input property of the Envelope Generator. You will see the ramp run from 0 to 100. The volume of the Sound Player is now 100.
- Hit the space bar. You will be in the Scene called “Init Part II”. This scene looks for the space bar to take you back to the previous scene. Hit the space bar again.

We return to the Scene called “Initializing”, but unlike last time, we can hear the sound playing because the value of the volume was 100 when we *left* the Scene. Remember, when you leave a Scene, every Isadora value is remembered so that when you return to the Scene, things will function exactly as they did when you left. But what if you wanted to make sure that, upon returning to this scene, the sound always started off with a volume of 0 so that it would be silent until you clicked the Envelope Generator’s trigger input. That’s where the “Init” value comes in.

- Click on the word volume in the Sound Player. The inspector for that property will appear. Click the checkbox next to “Init” to check it. Enter the value 0 into the value edit box next to the word Init.
- Again, click the trigger input of the Envelope Generator and then hit the space bar to go to “Init Part II”. Then hit the space bar again to return to “Initializing”. You won’t be able to hear the sound, as its volume has been initialized to 0.
- Now click the trigger input of the Envelope Generator. The sound will fade in, its volume going from 0 to 100.

Fully understanding how to scale and initialize values as they pass from one actor to another is the key to getting exactly what you want out of Isadora. Try more experiments with this feature in your patches to familiarize yourself with this important feature.

Tutorial 9: More Real Time Video Processing

In the previous chapter on real time video processing, we only looked at the Video Processing actors that have one video input and one video output. There are a handful of actors that take two or three video inputs. We’ll take a look at several of them in this tutorial.

Video Mixer

- Close any currently open Isadora documents. Then choose **File > Open** and locate the file called “Tutorial 9” in the “Isadora Tutorials” folder, located in the same folder as your Isadora application.
- Activate the Scene called “Crossfade” by clicking on it. In it you will find two Movie Player actors, a Projector actor, and an actor we haven’t seen yet called Video Mixer. A Mouse Watcher is connected to the mix

- Choose **Windows > Show Stages**. Note that you won't see anything yet, as the input to Projector hasn't been linked to anything yet.
- Move the up and down. As you do, the image on the Stage crossfades from one video to the other.

The Video Mixer actor fades between two video sources. When its mix amount property is 0, you see only the video stream arriving at its video in 1 input. As the value increases, you see more and more of video in 2 until you reach 100, when the video from that input is all that you see.

Luminance Key

- Activate the Scene called "Luminance" by clicking on it. In it you will find two Movie Player actors, a Projector actor, and an actor we haven't seen yet called Luminance Key.
- So that you know what imagery you are dealing with, link the video out of the top Movie Player to the video in of the Projector. You should see a dancer moving on a black background. Choose **Edit > Undo** to undo the link. Do the same with the video out of the bottom Movie Player. You should see some bubbles floating on a blue background. Again choose **Edit > Undo** to remove the link.
- Now, connect the video out of the Luminance Key to the video in of the Projector. What you will see on the Stage is the dancer superimposed on the bubbles.

What the Luminance Key actor does is combine two images. You specify a range of brightness in its key top and key bottom properties. Where the foreground video stream is within this range of brightness, you see the foreground. Where it is outside this range, you see the background.

Currently the key top is set to 100% and the key bottom to 5%. (100 means as bright as possible, 0 means black.) The dancer's body is fairly bright so it falls within the 100 to 5 range and you see the foreground, i.e., her dancing. But the black background is outside of the range 100 to 5, so the bubbles show through on that part of the image.

- Change the key top value to 5 and the key bottom value to 0.

Now you see a silhouette of the dancer, showing the bubbles inside of that outline. We've reversed the operation: we see the foreground image where that image is dark and the background image where it is bright.

You can experiment further by connecting the Mouse Watcher's horz pos. and vert pos. to the key top and key bottom properties and moving the mouse around the screen. Note that as you move the mouse around, the graphic in the center of the Luminance Key actor will give feedback regarding the range of brightness currently specified by the key top and key bottom properties.

Displace

- Activate the Scene called “Displace” by clicking on it. This time you will find a Movie Player, a Picture Player, a Projector, and yet another actor we haven’t seen called Displace.
- So that you know what imagery you are dealing with, link the video out of the Movie Player to the video in of the Projector. You should see a dancer moving on a black background. Choose **Edit > Undo** to undo the link. Do the same with the video out of the Picture Player. You should see some bubbles floating on a blue background. Again choose **Edit > Undo** to remove the link. Now, connect the video out of Displace to the video in of the Projector.
- You should see the dancer on the black background. Now, use the mouse to adjust the displace amt property in the Displace actor. As you increase its value, the dancer’s image will become more and more distorted.

Displace uses the brightness of the video stream at its displace input to shift the pixels of the video stream arriving at its source input. Where the displace video is 50% gray, the source video’s pixels aren’t moved at all; where it is dark, pixels are shifted to the left; where it is light, pixels are shifted to the right. How far the pixels are moved depends on the amount setting.

The angle property determines the angle at which pixels are shifted: when set to zero, they move left and right, when set to 25% (90 degrees) they move towards the top-left and bottom-right, etc. The offset parameter will shift the apparent brightness of the displace video – this is useful if the displace video is too bright or too dark overall. Experiment with these to see how they change the result.

It is hard to predict what exactly you will get out of Displace, but the results can be quite beautiful. Import your own movies and try using them with Displace. Remember, though we used a still picture as our displace source, you can use a moving video image or live video input just as easily.

Video Feedback

Video Feedback (pointing a video camera at the monitor that was displaying the image from that camera) was a staple technique of some early video artists. Here we’ll use a pair of Isadora video processing modules to create our own digital version of this technique.

- Activate the Scene called “Feedback” by clicking on it. This time you will find Movie Player, Luminance Key, Zoomer, and Projector actors. Note how this patch is linked: the dancer video is the foreground input to the Luminance Key, and the key’s video out goes to the projector. But that same output also goes to the video in of Zoomer whose output goes to the background input of the Luminance Key. In essence, we’ve created a loop with the Zoomer actor manipulating the Luminance Key’s output and feeding it back into itself.
- Take a look at the resulting image. You will see a kind of “decay” around the dancers body as she moves. This decay is because the Zoomer module is scaling

the image down by 1%, making it just a tiny bit smaller. By keying the original image with a scaled down version of itself, you get these lovely trails.

- Experiment with all five parameters of the Zoomer module. You will get a wide range of effects, from subtle to explosive. Also try adjusting the key top and key bottom properties of the Luminance Key module.

Tutorial 10: Making Your Own Actors

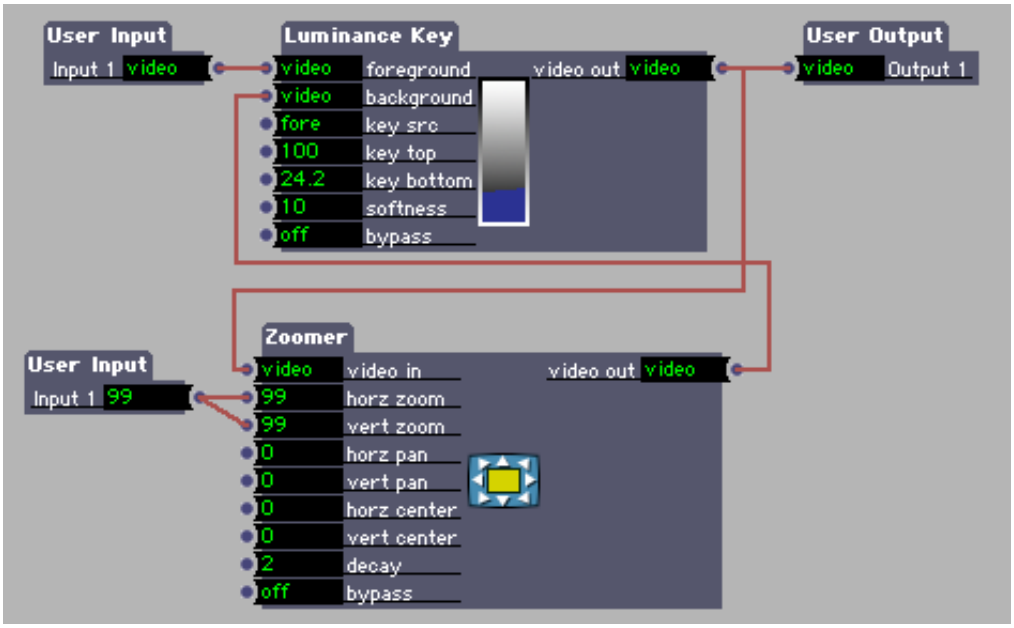
As you use Isadora, you will find that there are groupings of actors that you often use. This tutorial shows you how to use Isadora's *User Actors* allow to build your own actor with several Isadora actors

In this example, we will take two actors (Luminance Key and Zoomer) and turn them into our own actor called "Feedbacker".

- Close any currently open Isadora documents. Then choose **File > Open** and locate the file called "Tutorial 10" in the "Isadora Tutorials" folder.
- Click on the Scene called "Feedback" to activate it. (This is the same Scene we looked at in Tutorial 9.)
- Click on Group 8 in the Toolbox. This is the User Actor Group.
- Bring a User Actor into the current Scene. Initially, the user actor will look like this

because it does not yet have any inputs or outputs.

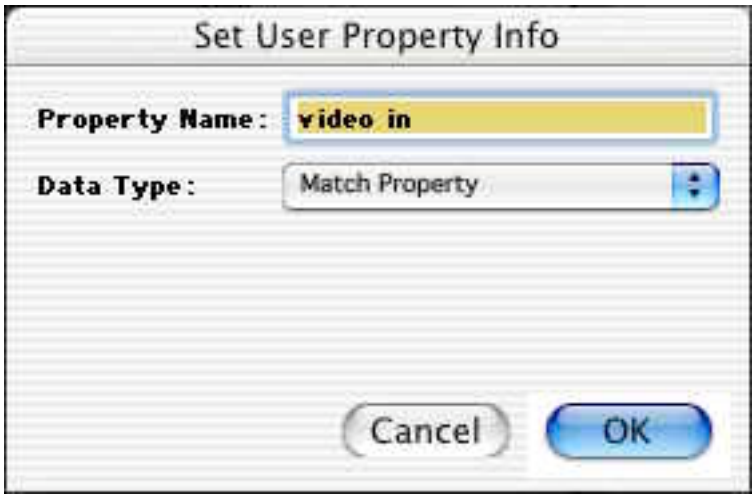
- Select the Luminance Key and Zoomer actors and choose **Edit > Cut**.
- Double-click the User Actor. A new Scene Editor will appear, which looks exactly like a normal Isadora document, except that it does not have a Scene List at the bottom. Note too that the title of this window is "Tutorial 10.izz : User Actor". This shows you that this User Actor belongs to the document "Tutorial 10.izz" and that it is currently called "User Actor". We will change the name of this user actor in a moment.
- Choose **Edit > Paste** to paste the Luminance Key and Zoomer actors inside of the User Actor.
- Click on group number 8 above the Toolbox. When you are inside a User Actor's editor, the User Group has three more actors available: User Input, User Output, and User Actor On/Off.
- Bring two User Input actors and one User Output actor into the Scene.
- Make a link from the first User Input to the video input of the Luminance Key actor, and the from second to both the horizontal and vertical zoom inputs of the Zoomer actor. Then connect the User Output to the video output of the Zoomer actor. The User Actor's editor now looks like this:



Note that when you linked a User Input or User Output to another actor, it will change to match the properties of the input or output to which they were connected. This includes the type, minimum and maximum, and the scale minimum and scale maximum, etc. In this case, both two of the actors changed to a type of video because they were connected to a video input or output. The third actor, connected to the zoom inputs of the Zoomer, changed to an Integer with a minimum of 0 and a maximum of 1000. You can change this behavior using the Set User Property Info dialog described next.

At this point your using actor is complete. But it is a good idea to rename your User Inputs and Outputs so that their function is more descriptive. Here's how:

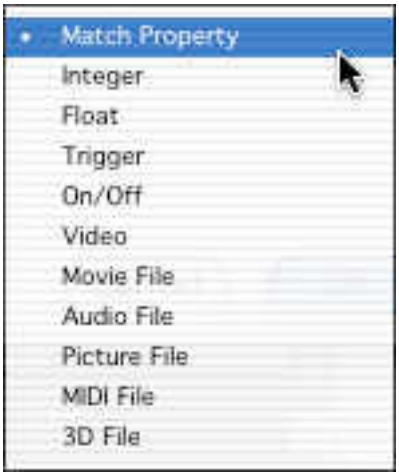
- Double-click on the first User Input. The Set Property dialog box will appear.



- Type "video in" into the Property Name field to give this input a name.
- Click OK

- Do the same for the User Output, calling it “video out”.
- And finally, change the name of the Second User Input to “Zoom”.

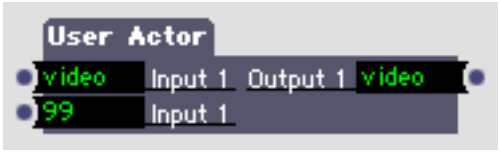
Note also the **Data Type** popup menu. By default, this popup is set to *Match Property*, which means that the User Input or Output will adapt to match the properties of whatever actor to which it is connected. If you want to force a User Input or Output to a particular type, you can select it in this menu. The other choices are:



- Integer: sends/receives an integer number (i.e., no digits after the decimal point.)
- Float: sends/receives a floating point number, i.e., a number that can have numbers after the decimal point.
- Trigger: sends/receives a trigger.
- On/Off: sends/receives an integer value that is either on (1) or off (0).
- Video: sends/receives video.
- Movie/Audio/Picture/MIDI/3D File: sends/receives an integer number that represents the number of an object in the Media Window. The name of the file is displayed with the number.

In this case, we don’t need to change the Data Type of our User Input and Output, so you can leave it set to Match Property.

To close the editor for your User Actor, choose **File > Close**. The editor window will close, and you will now see your user actor in the Scene Editor of the main document.



The final step is to name the User Actor itself.

- Select the actor by clicking on it.

- Choose Actors > Rename Actor. A text edit box will appear above the actor.
- Type “Feedbacker” and press the return key.

Your actor is complete. You can freely copy and paste this actor into other Scenes, just like any other actor.

Adding Your User Actor to the Toolbox

You can add your User Actor to the Toolbox so that it will be available in other Isadora documents. This section shows you how.

But, before you can do so, you must choose a folder within which Isadora will save your User Actors. This is necessary so that, when Isadora is opened, it knows where to look for your custom actors. To choose this folder:

- Create a folder on your computer to hold your User Actors. Your “Documents” folder is a good place to put this, but you could also locate the folder in the same folder as the Isadora application.
- Choose **Actors > Set Global User Actor Folder**.
- Using the file dialog that appears, select your User Actor folder.
- Click OK.

Once your User Actor Folder is defined, you can save your new Actor to the toolbox.

- Select your User Actor by clicking on it.
- Choose **Actors > User Actor To Global Toolbox.**
- Isadora will automatically switch to Group 8 in the Toolbox. You will now see your User Actor listed there.

Now, whenever you create a new document, your User Actor will be available in the toolbox.

Sharing Your User Actors

If you would like to save a User Actor you’ve made so that you can share it friend, you can do so by using the **Save User Actor** command. You can also load another User’s actor using the **Place User Actor** command.

To save your actor:

- Click on one User Actor so that it is selected.
- Choose **Actors > Save User Actor…**
- Use the file dialog that appears to choose a place to save your actor.
- Click OK.

The actor will be saved to your hard disk with the extension “.isa” which stands for Isadora Actor.

To load an actor you've received from someone else:

- Choose Actors > Place User Actor…
- Use the file dialog that appears to choose the User Actor you want to load.
- Click OK.
- The User Actor will now be tracking your mouse, as if you had clicked on it in the Toolbox. Click once to deposit the actor into your scene.

Alternatively, you can just drop the User Actor into your Global User Actors Folder (described in the previous section). If you do, it will appear in the User Group in the Toolbox the next time you run Isadora.

Tutorial 11: Getting the Most From the Projector (v1.1)

Isadora 1.1 introduced a new feature: **Hardware Accelerated Rendering** to the stage. This feature uses OpenGL, the same system software used to render the scenes in 3D games. Several features were added to the Projector actor to take advantage of this new scheme, and understanding how to use them will allow you to take full advantage of the capabilities introduced in version 1.1.

The first step is to ensure that the Hardware Acceleration is enabled and that it works on your computer.

- Chose **Isadora > Preferences** (MacOS) or **Edit > Preferences** (Windows) to show the Preferences Dialog.
- Click on the Video tab.
- Make sure that the "Hardware Accelerated Rendering" checkbox is checked.
- Click OK
- Choose, **Windows > Show Stages**.
- Again, choose **Isadora > Preferences** (MacOS) or **Edit > Preferences** (Windows) to show the Preferences Dialog and click the "Video" tab. Under the "Rendering to Stage" section, you will now be able to see some of the OpenGL features available on your computer.

Rendering To Stage
Hardware Accelerated Rendering (OpenGL)
Features: Vers = 1.5 ATI-1.3.28, Packed Pixels, Rectangular Textures, Native YUV

- The most important feature is “Rectangular Textures” – having this feature is very import to speeding up the rendering process. If you don’t have this feature, the Hardware Acceleration may not work well for you.
- Click OK to close the Preferences Dialog.

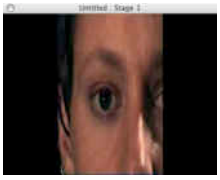
Once you’ve ensured that Hardware Rendering is enabled, you can start working with the new Projector actor features.

- Close any currently open Isadora documents. Then choose **File > Open** and locate the file called “Tutorial 11” in the “Isadora Tutorials” folder, located in the same folder as your Isadora application.
- Choose **Windows > Show Stages** to show the stage. If the Stage fills the screen, press Command-G (MacOS) or Control-G (Windows) to hide it. Then choose **Windows > Force Stage Preview**, and again choose **Windows > Show Stages** to show a smaller version of the stage.
- Click on the scene labeled “First Test”. This scene simply plays a movie. If you see the movie being drawn on the Stage, skip to the next step. If you don’t see the movie in Stage 1, then your computer is not capable of hardware acceleration. You should turn off Hardware Accelerated Rendering in the Preferences menu and discontinue the remainder of this tutorial.

The Projector Actor

Since in V1.0 of Isadora, it has always been possible to position and shape the image within the frame. This is accomplished using five parameters: left, top, width, height, and zoom.

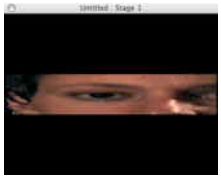
Left and Top control where the image appears on the stage, from 0 to 100% of the Stage width and height, respectively. Width and Height control how wide and tall the image is, again from 0 to 100% of the stage width and height. Zoom controls the size of the image, and can range from 0 (invisible) to 50% (half size) to 100% (normal size) all the way up to 1000% (i.e., 10 times the normal image size.) Below are some example settings:



Width 50% - Height 100%

Left 25% –!Top 0%

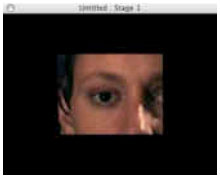
Zoom 100%



Width 100% - Height 50%

Left 0% –!Top 25%

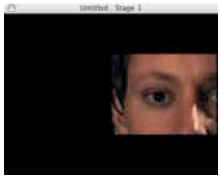
Zoom 100%



Width 100% - Height 100%

Left 0% –!Top 0%

Zoom 50%



Width 100% - Height 100%

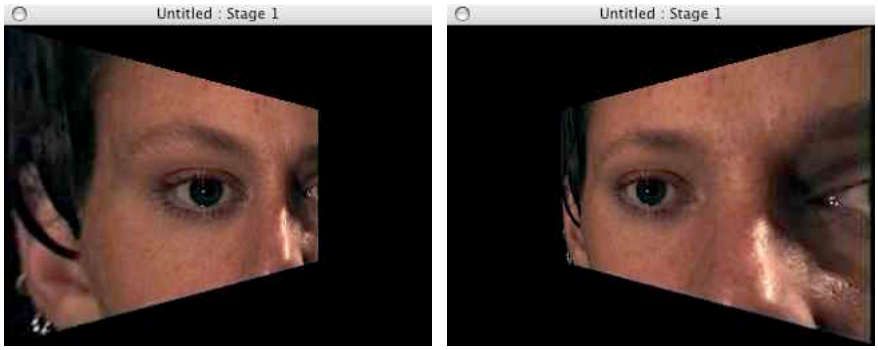
Left 25% –!Top 0%

Zoom 50%

Note that when you change the Width and Height parameters, the image will be squeezed in one direction or another. By changing these parameters you can reshape the image and change its aspect ratio.

Experiment with these five settings to see how they affect the image. When you are done, restore the projector to its default values by selecting the Projector actor and choosing **Actors > Reset to Default Values**.

Three of the new features (available only when **Hardware Accelerated Rendering** is enabled in the Preferences) have to do with how the image is shaped. They are: spin, aspect, and perspective. Spin does exactly what its name implies: it rotates the image by a specified number of degrees. Aspect ratio allows you to adjust the ratio of the image's width to height. Negative numbers reduce the height while positive numbers reduce the width. Perspective is a bit like the "keystone" control on a video projector, except that it adjusts the image horizontally instead of vertically. It is best explained by showing an example: the left image has it's perspective input set to –10, while setting it to +10 produces the right image.



Experiment with these three settings. Restore the projector to its default values by selecting the Projector actor and choosing **Actors > Reset to Default Values** when you are done.

In Isadora 1.1 it became possible to display two or more images on the same stage by using multiple Projector actors in the same scene. To take best advantage of this capability, it is essential to understand the blend, intensity, and layer input properties.

The layer input property controls the layering of the images. Higher numbers are closer to you; lower numbers are further away. So, if you have two Projector actors, in the same scene, and layer input of the first one is set to 5, and the layer of the second is set to 4, then the image from the second projector will be drawn behind that of the first.

There are three blend modes: additive, transparent and opaque. Additive means that the two images are literally "added together" – they will both be visible at the same time, even when one is on top of the other. When using this setting, the intensity parameter simply controls the brightness of the image. Transparent means that the transparency of the image can be adjusted using the intensity parameter. If intensity is set to 100, then the image will be opaque, and you won't be able to see the image behind it. As the intensity approaches zero, the image will become more and more transparent, allowing you to "see through" to the images below. The opaque blend mode means the image's rectangle is always opaque. So, as the intensity approaches zero, you will see a black rectangle on top of any images rendered behind it.

For a deeper explanation of these parameters, please see the section entitled "Compositing with the Projector using Hardware Accelerated Rendering" on Page 144.

Optimizing for Speed

There are many factors that influence Isadora's video processing speed, including the speed and type of your processor, amount of RAM installed on your computer, hard disk speed, the format in which the video files are stored, and several other factors. This section details several tips to help you get the very fastest frame rates from Isadora.

Tip 1: Use the fastest computer you can, preferably with a G4 Processor (MacOS) or MMX Enhanced Processor (Windows)

Much of the code inside Isadora is optimized for these special processors. Using a G4 or MMX enabled machine will result in significant speed increases when compared to G3 or non-MMX processors. (Note: All Pentium 3 and 4 processors have MMX.)

Tip 2: Add as much RAM (Random Access Memory) to your computer as possible.

Modern MacOS and Windows computers use a feature called "virtual memory". When the computer senses that some data that resides in your computers RAM (i.e., the extremely fast internal memory linked to your processor) has not been used for a while, it will write it out to disk to make more RAM available to other applications. This is called "page swapping" and can adversely affect performance.

The best way to solve this problem is to add more RAM to your computer. As a general rule, 512 megabytes is a good amount. 1 Gigabyte is even better. Page swapping will often take place on a 128-megabyte machine with more than one application running.

Tip 3: Don!t run other applications at the same time as Isadora

Every running application consumes system resources. So, especially when using Isadora for a live performance, don't run any other applications at the same time. Even if they aren't "doing anything" they get some of the processor's time, and thus slow down Isadora.

Tip 4: Store Video Files at a resolution of 320 x 240 or 400 x 300

A full sized frame of Digital Video has a resolution of 720 x 480 (That's a total of 345,000 pixels that each video effect must process – a substantial number for even the fastest computers. By reducing the resolution of your movies to one-half (i.e., 320 x 240) you reduce the number of pixels that must be processed by 75%, resulting in an equivalent speed up in processing.

You may also have noticed that 360 is exactly half of 720 (the standard DV-NTSC width), so why store your movies with a horizontal resolution of 320 and not 360? This is because you want the "aspect ratio" (the ratio of width to height) of the

video image and the output device (i.e., a video monitor or video projector) to match. The aspect ratio of a DV frame is 3 to 2, while a second monitor or projector attached to your computer will almost always have an aspect ratio of 4 to 3. A video with a resolution of 320 x 240 has an aspect ratio that matches the output device, allowing Isadora to use optimized code to render the image to the screen.

If you would like to have a bit more resolution, you can compress your movies at 400 x 300. But this means that you should also set your output device to 800 x 600 to get the highest rendering speed (see below.)

You can use a number of software tools to convert your 720x480 DV-NTSC files to a 320 x 240 format. But perhaps easiest is the Pro edition of Apple's QuickTime Player. See Tip 10 for instructions on how to use QuickTime Player to compress your video.

Tip 5: Keep all video resolution consistent

When Isadora has to combine two video streams of different resolutions (e.g., with the Video Mixer actor), it has to scale one stream to match the resolution of the other. (Which one gets scaled is determined by the "Video Image Processing" section of the Video tab in the Preferences.) Scaling is slow, and so you want to avoid it as much as possible. If all of the video streams you are processing are the same resolution, you will get the best possible performance.

Tip 6: Compress your video files using the Photo JPEG codec.

In addition to changing the resolution of your files, recompressing them with the Photo JPEG *codec* (compressor/decompressor) offers further speed improvements when playing video from your hard drive. While the files will not be as small as with other codecs, the Photo JPEG compressor offers several advantages. The first, and most important, that it requires less processor power to decompress the images when compared to many other codecs. Secondly, it is enhanced for the G4 processor on Macintosh computers (many other codecs are not.) Third, because each frame is compressed as an individual picture, it is *very* fast when jumping to an arbitrary location within the clip (i.e., when using the position input of the Movie Player) and it plays just as well backwards as forwards.

You can use a number of software tools to recompress your files using the Photo JPEG codec But perhaps easiest is the Pro edition of Apple's QuickTime Player. See Tip 10 for instructions on how to use QuickTime Player to compress your video.

Tip 7: Set the resolution of your output to an even multiple of the video being processed by Isadora, and use the 'direct! option in the Projector.

When the resolution of the output device (i.e., the second video output on your computer) is an exact multiple of the video being sent to it, Isadora uses highly optimized code to render the video. If the video images being processed have a resolution of 320 x 240, setting the output resolution to 640 x 480 (i.e., exactly

double in both dimensions) allows Isadora to use this special code. If you render your movies at 400 x 300, set your video output to 800 x 600 to enable this optimized code.

IMPORTANT: To take advantage of this feature, you must set the 'mode' input on your Projector actor to 'direct'. The 'mode' input is set to 'copy' by default because 'direct' works on almost every computer, but not absolutely every one.

Tip 8: When capturing live video, set the Video Capture Size to *Half* and make sure the *Force 4:3 Aspect Ratio* menu item is checked.

For the same reasons listed above, having the live video appear at half resolution makes everything run faster. To do this, from the Capture menu choose **Video Capture Size > Half**. Turning on the **Force 4:3 Aspect Ratio** ensures that the live video is in the same ratio as the recorded clips, again saving processing power.

Now, on some cameras (notably the Apple iSight) the resolution of the camera is actually double that of a DV Camera. (You can see this by looking at the image in the Video Preview window.) In this case, you may need to set the Video Capture Size to Quarter.

Tip 9: Turn off the Video Capture when you!re not using it.

The Capture Control actor in Group 7 allows you to turn live video on and off from within an Isadora scene. If you are not using live video in a section of your piece, then use this actor to turn it on and off at the appropriate moment.

Note, however, that turning on the live video capture can take as long as 1/3 of a second, and this may result in a visible glitch in your video output.

Tip 10: If you only need to capture video and not sound, then use Start Video Only Capture and vice-versa.

If you only need the video coming from the camera, and not the audio (i.e., you're not using the Sound Level Watcher or capturing live sound to disk) then just enable the video capture and not the audio capture. Similarly, if you only need the sound input but don't need video, use the Start Audio Only Capture.

Tip 11: How to use Apple!s QuickTime Player (Pro Edition) to recompress your movies.

As mentioned above, movies stored using the Photo JPEG codec at resolution of 320 x 240 will give excellent performance when they are played back in Isadora. Below are instructions on how to use the Apple's QuickTime Player to store your movies in this format.

NOTE: While QuickTime and QuickTime Player are free, the Pro edition required to recompress movies costs $29.95 at the time of this writing. You must have the Pro Edition to recompress movies using QuickTime Player.

1) Open QuickTime Player by double clicking on its icon. From the File menu select “Open Movie” to open the movie you want to recompress.
2) Choose **File->Export** or press **Cmd-E** to call up the export dialog.
3) After the window appears, click the **Options** button to show the “Movie Settings” window.
4) Then click the **Settings** button.
5) Choose **Photo JPEG** using the pop-up menu under the heading “Compressor”.
6) Set the slider under “Quality” to the halfway point, which should be labeled “Medium.” You can use “High” if you like – you’re movies will be somewhat larger but the quality of the image will be better.
7) In the text box to the right of “Frame Rate” type 30, if it is not already set to 30. (Use 25 if you are compressing PAL movies.) Uncheck the other two boxes that say Key Frame and Limit Data Rate.
8) Press the **OK** button.
9) You’re back at the Movie Settings window. Click on the **Size** button.
10) Click the “Use Custom Size” radio button. Two text boxes marked **Width** and **Height** will appear.
11) Type 320 into the Width text box, and 240 into the Height text box.
12) Press the **OK** button.
13) You’re back at the Movie Settings window. Press the OK button.
14) Choose a name for your movie (it should be different than the old name) and press the **Save** button.
15) This process can take a while, depending on how long your movie is. A progress dialog (a window with a little blue thermometer type display) will appear to show how things are going.
16) When the progress dialog disappears, your movie is done.
17) Open the new movie and play it to see how it looks now.

To see the difference in size between the original movie and the newly compressed one, do the following:

1) Bring the original movie to the front by clicking on its window.
2) Choose **Movie->Get Info** to show a window that gives information about the movie.
3) Choose “Movie” from the pop-up menu on the top left.
4) Choose “General” from the pop-up menu on the top right.
5) Look at the “Data Size” and “Data Rate” in that window. Take note of the values.
6) Close the window by clicking on its close box in the top left or by choosing **File->Close**.
7) Now bring the new movie to the front by clicking on its window.
8) Follow the same procedure starting at Step 2 to show its Data Size and Data Rate.
9) You’ll see how much smaller the movie is and how its data rate has been lowered through the resizing and compression process.

Isadora Reference

Importing & Managing Media

Media Window Basics

Isadora allows you play and manipulate movies, audio files, pictures and standard MIDI files. To use these files, you must create references to them in the *Media Window*.

The Media Window can contain any number of bins, each of which is associated with a particular media type. Each bin can contain any number of media files. You can organize your files by creating new bins and dragging existing media references into them.

When you do import media, Isadora automatically places the media files in the first available bin of the matching type in the Media Window, i.e., movie files go into the first movie bin, sound files go into the first sound bin, etc.

It is important to understand that the Isadora document does not contain the actual media file data –!just a pointer to it on your hard drive or other storage device. If you later delete the file, Isadora won't be able to find it. It is a good idea to create a folder to hold your Isadora document and all of the media associated with it. This should make it easier to manage your data when you are working with many files.

Isadora can import and play several types of movie, sound, and picture file formats., namely:

Video Files
- QuickTime Movies (.mov)
- Digital Video Files
- Shockwave Files (.swf)

Sound Files
- Audio Interchange Format Files (.aif, .aiff)
- Windows Wave (.wav, .wave)
- Sound Designer II (.sd2)

MIDI Files
- Standard MIDI Files (.mid)

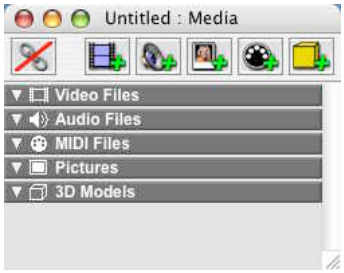
Pictures
- Macintosh Pictures (.pic)
- QuickTime Image (.qtif)
- Windows Bitmap (.bmp)
- Photoshop Documents (.psd)
- TIFF (.tif)

Graphics Interchange Format (.gif)
PNG (.png)
SGI Image Files (.sgi)
Mac Paint (PNTG)
Targa Image Files (TPIC)

Importing Media

To import one or more media references using a File Selector dialog:

- Choose **Windows > Show Media** to show the Media Window. Initially, it will look like this:



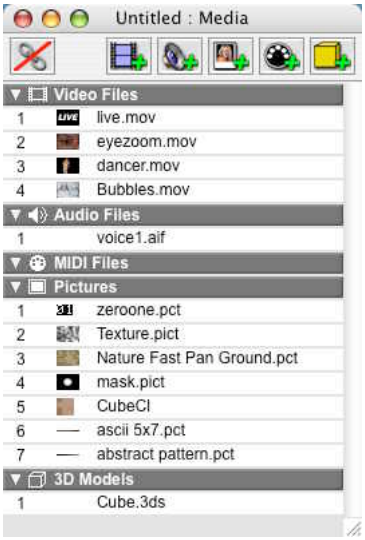
- Choose **File > Import Media…**. A file selection dialog will appear.
- Or, control-click (MacOS) or right-click (Windows) to show a pop up menu. From that menu, choose “Import Media…”.
- Select the file you want to open by clicking on it, and then click **Open**. If you like, you may shift-click to select several files (they can be of different types) and then click **Open**.

To import one or more media references using Drag and Drop:

- Select the file or files you want to import in the Finder (MacOS) or in from the Explorer (Windows).
- Drag the files over the Media Window. Its outline will highlight to indicate that it is ready to receive files. If the group of files you have selected contain a file type that Isadora cannot read (i.e., not a Movie, Sound File, MIDI file, or Picture) then no highlighting will appear.
- Release the mouse button to import the files.

All of the files you have selected will be imported into Isadora and appear as reference in the Media Window. The references will be stored in the first available bin of that matches the type of file you dragged.

Here is how the media window looked after we dragged in three movies, one sound file, and seven pictures and one 3D model:



Note the number to the left of the each media reference. This number is used to identify the media when specifying which one you want to play inside an actor.

To replace the file associated with a media reference:

- Double-click the media reference (it is OK if the reference is currently <Unassigned>).
- Or, control-click (MacOS) or right-click (Windows) the media reference to choose “Replace Media…” from a pop-up menu.
- A file dialog will appear that allows you to select a different file to associate with that media reference.
- Select the new file and click **Open** to confirm the new file. The name of the reference in the Media Window will change to match that of the newly selected file.

Selecting Media References

To select an item or bin:

- Click on a media reference to select it. Clicking on a bin selects the bin and all media references inside that bin.

To select multiple media references

- Click on an unselected media reference to select it. Then hold down the shift key and click another item to select all items in between.
- Or, Click on an unselected media reference and drag to select several contiguous items.
- You can hold down the Command/Apple key (MacOS) or the Alt key (Windows) and click a media reference to toggle its selection state.

To select an multiple bins

- Click on an unselected bin to select it. (All media references within that bin will be selected too.) Then hold down the shift key and click another bin to select all items and bins in between.
- Or, Click on an unselected bin and drag to select several contiguous bins.
- You can hold down the Command/Apple key (MacOS) or the Alt key (Windows) and click a bin to toggle its selection state.

Managing Media

To add a new bin to the Media Window

- Click on the appropriate button at the top of the Media Window.

Add Movie Bin Button

Add Sound Bin Button

Add Picture Bin Button

Add Midi Bin Button

Add 3D Bin Button

- A new bin of the specified type will be added to the end of the Media Window.

Automatically Adjusting Media Numbers

When you delete or move a media object, the number of the media objects will change, and Scenes that reference a given media object will not play the same file they played before the change. Often this is the behavior you want, but it may be that you want to ensure that all the actors still play the same media after you have deleted or moved some object in the Media Window. To do this, you need to enable the “Auto Adjust Media” feature in the Media Window.

Auto Adjust Media Enabled

Auto Adjust Media Disabled

To enable or disable the Auto Adjust Media feature:

- To turn on the Auto Adjust Media feature, click the button in the top left of the Media Window.
- To turn off the feature, click the button again.

To delete a media reference or bin:

- Select the media references you want to clear.
- Choose **Edit > Cut** to remove the references from the Media Window. Or, control-click (MacOS) or right-click (Windows) the media reference to choose “Cut” from a pop-up menu.

To clear (unassign) a media reference:

- Select the media references you want to clear.

- Choose **Edit > Clear** to clear the references from the Media Window. Or, control-click (MacOS) or right-click (Windows) the media reference to choose "Clear" from a pop-up menu.
- After a reference is cleared, its title will read "<Unassigned>". Attempting to play a media reference that has been unassigned has no effect –!the media simply doesn't play.

To hide the media references within a bin:

- Click on the downward pointing arrow to the left of the bin's title. The items within the bin will be hidden.

To show the media references within a bin:

- Click on the sideways pointing arrow to the left of the bin's title. The items within the bin will be shown.

To reorder media references within a bin, or to move them to a different bin:

- Select the media references you want to move. You should only select media references of the same type (i.e., only movies, only audio files, etc.)
- Click a second time on one of the selected items and drag the media references. As you do, an insertion point will appear between pairs of existing media references or below an existing bin. This let's you know where the media references will be inserted when you release the mouse.
- Release the mouse button when the insertion point indicates the desired position of the media references. When you do, they will be moved to that position.

Note: Using *High Quality* Flag with Movies in v1.1

Previous versions of Isadora did not respect the "High Quality" flag that can be set with any movie in QuickTime Player or other applications. (Mostly this would be used with full resolution DV movies.) The only reason that you need to pay attention to this is that if you were using movies with the High Quality flag set in previous versions, they would have played with less CPU load than they will in the current version of Isadora. So, if you see a degradation of performance on some movies, you should open them and check the flag in QuickTime Player.

Using the Scene List

An Isadora document can have any number of Scenes, each of which is a collection of actors that manipulates one or more streams of digital media. Isadora scenes are like scenes in a play: each one may have a different set, different lighting, etc. Similarly, each Isadora Scene may manipulate media in a completely different way. Because you can jump almost instantly from one scene to another using the Jump actor or by clicking on Scenes in the Scene List, it is possible to move from one interactive setup to another as you move through sections of a performance.

When you manually activate a Scene in the Scene List by clicking on it with the mouse, its actors are displayed in the Scene Editor and they all begin communicating with each other. If the activated Scene generates video output, it will appear on the appropriate Stage, if it produces sound, the sound will be sent to the computer's audio output, etc.

It is important to understand that each Scene is completely independent from the other Scenes in the same document. Because of this you cannot pass data from one Scene to another. When you activate a new scene, all of the media output of the previously active scene stops.

Generally speaking, only one scene is active at a time. However, you can use the Activate Scene and Deactivate Scene actors to activate more than one scene at a time. See the documentation for these two actors for more information.

Each Scene is visually represented by rectangular shaped objects displayed in the Scene List at the bottom of an Isadora document.

Each Scene is associated with a Control Panel, indicated by the bar just below the Scene proper. (When the bar goes between two or more scenes, it indicates that those Scenes share the same Control Panel.) Control Panels allow you to create a user interface for your Scene consisting of one or more Isadora controls. See the section "Using Control Panels" on Page 148 for more information.

Activating & Deactivating Scenes

To activate a Scene manually:

- Click on the Scene you want to activate, which means that that Scene will be selected. The highlighting on the previously activated scene (if there was one) will be removed, the Scene you clicked on will be highlighted, the actors for the selected Scene will appear in the Scene Editor, and they will begin communicating with each other and the outside world.

To deactivate the currently active Scene, leaving no Scenes active:

- Click on the background area of the Scene List. If there was a scene activated, its highlighting will be removed and its actors will disappear from the Scene Editor indicating that no Scene is active currently. This will stop all output (video, sound, MIDI) that was being generated by the Scene that has been deactivated.

Selecting Scenes

To select a Scene:

- Click on the Scene you want to select, which means that that Scene will be activated. The highlighting on the previously activated scene (if there was one) will be removed, the Scene you clicked on will be highlighted, and the actors for the selected Scene will appear in the Scene Editor.

To select a range of scenes:

- Click on the first scene in the group you want to cut or copy. It will highlight to indicate that it is selected.
- Shift-click on the last scene in the group you want to select. Isadora will highlight the second scene you clicked, and all of the scenes in between. Note that the Scene Editor will disappear, because you cannot have more than one scene active at a time.

To make a discontinuous selection, or to deselect one or more selected scenes:

- Hold down the Command (⌘) key (MacOS) or Alt key (Windows) and click on the scenes that you want to select. If it was not selected previously, it will be selected. If it was selected previously, it will be deselected.

Adding and Removing Scenes

To insert a new scene into the Scene List:

- Click to the left of the first scene, to the right of the last scene, or in between two scenes. A blinking cursor will appear at the spot where you clicked. This indicates where the new scene will be inserted.
- Choose **Scenes > Insert Scene**. A new scene will appear where the blinking cursor was previously. You can see that it has been activated because the new scene will be highlighted and the Scene Editor will be visible.

To activate a scene:

- Click on the scene you want to activate. It will highlight to indicate that it is selected, the Scene Editor will be shown (if it isn't already visible) and all of the modules in that scene will be visible inside the Scene Editor.

Note that you can activate a new scene from within a Scene by using the "Jump" actor.

To cut or copy a range of scenes:

- Select one or more scenes.
- Choose **Edit > Cut**. Isadora will cut the selected scenes.

To paste scenes:

- Click to the left of the first scene, to the right of the last scene, or in between two scenes. A blinking cursor will appear at the spot where you clicked. This indicates where the scenes will be pasted.
- Choose **Edit > Paste**. Isadora will insert scenes that you cut or copied previously at the point where the cursor was blinking.

To delete scenes:

- Select one or more scenes.
- Choose **Edit > Clear** or press the **Delete** key. Isadora will delete the selected scenes.

Reordering Scenes

To change the order of the Scenes in the Scene List:

- Select one or more scenes.
- Click in one of the selected Scenes, and drag the mouse to the right or the left.
- As you drag, a black cursor will appear between the Scenes. This shows where the Scenes you are dragging will be inserted when you release the mouse. In the example below, the cursor is between scenes “test3” and “test4”.

- When the cursor is displayed at the location where you would like the Scenes to be inserted, release the mouse button. The Scenes will be move to that location.

Renaming Scenes

To change the name of a scene:

- Highlight the scene whose name you want to change. Then choose **Scenes > Rename Scene**. A text edit box will appear in place of the scene.
- Type the new name of the scene and press *enter*. The text edit box will disappear and the scene will be displayed with its new name.
- **Shortcut:** Control-clicking (MacOS) or right clicking (Windows) will show a popup menu. From that menu choose “Rename Scene” to open the text edit box for a Scene’s name.

Editing Scenes and Using Actors

As described in the previous chapter, a Scene is a collection of actors that manipulates one or more streams of digital media. So, the Scene Editor is where you define the way in which those actors work together.

Using the Scene Editor, you place your actors and connect the outputs of one to the inputs of the other. In so doing, you define the how the media (whether it is video, sound, MIDI, etc.) is manipulated. You will also edit the property values associated with each actor here, allowing you to determine the specific way in which a given actor functions. Finally, you will edit how data is scaled as it moves through a link.

Most Scenes follow this model: a media stream arrives from a source, whether it be prerecorded media stored in the Media Window or media arriving in real time from the outside world; the media stream flows through one or more actors to change it in some way, and then the manipulated data is sent to an appropriate output. Interactive setups have an added component in that some information from the outside world is changing the way in which one or more actors manipulate their media streams in real time.

To understand what each of the actors do, take a look at the Tutorials or read the Isadora Actors Reference portion of this manual. This section describes how to add, remove, organize and connect actors within a Scene.

Adding New Actors to a Scene / Using the Toolbox

The actors available in Isadora can be found in the Toolbox, which is located along the left side of an Isadora document.

The actors have been divided into eight groups, indicated by the eight, circled numbers at the top of the Toolbox.

1. Video Group
2. Audio Group
3. MIDI Group
4. Generator Group
5. Mouse & Keyboard Group
6. Calculation Group
7. Control Group
8. User Group

When you select a group, the actors in that group become available in the Toolbox, so that you can bring them into a Scene.

To make a group of actors available in the Toolbox:

- Click on the circled number indicating the group you want to select. The number will highlight and the actors in that group will appear in the Toolbox, and the name of that group will appear directly below.

To see the names of the Toolbox groups:

- Move the mouse over the numbers above the Toolbox. The name of that group you are pointing to will be shown directly below.

To add a new actor into a Scene:

- Click in actor you want to add in the Toolbox. The cursor will change into a plus sign to let you know you have selected an actor.
- Move the mouse into the Scene Editor. As you do, you will see the actor you selected following the movements of your mouse.
- Once you have the actor in the position you desire, click the mouse to confirm its addition to the Scene.
- Note: You can click again the Toolbox or hit the Escape (esc) key to cancel the addition of the actor.

To move an actor into a different Toolbox group:

- Click in actor you want to move in the Toolbox. The cursor will change into a plus sign to let you know you have selected an actor.
- Click on the group number at the top of the Toolbox. The following dialog will appear:

- Click OK to confirm the move. Upon doing so, Isadora will switch to the actor's new group and show displays it along with the other actors.

Selecting and Deleting Actors

To select an actor:

- Click on the main portion of the actor with the mouse.

To select multiple actors:

- Hold down the shift key while clicking on the actors you want to select.

To select a group of actors:

- Click on the Scene Editor's background, and drag the mouse. A selection rectangle will appear. When you release the mouse, any actors under the selection rectangle will be selected.

- If you hold down the shift key before you click, the actors under the selection rectangle will be added to the current selection.

Organizing Actors

To reposition actors within the Scene Editor:

- Select one or more actors.
- Click on the main body of the actor and drag. The selected actors will follow the movements of your mouse until you release the mouse button.

Editing Actors

To delete actors:

- Select one or more actors.
- Choose **Edit > Clear** or press the **Delete** key. Isadora will delete the selected actors.

To cut or copy a range of actors:

- Select one or more actors.
- Choose **Edit > Cut**. Isadora will cut the selected actors, or
- Choose **Edit > Copy**. Isadora will copy the selected actors.
- Note that when cutting or copying a group of actors, all of the links between actors in the group will be kept intact. When you paste these actors, the links that were in place at the time of the cut/copy will be restored.

To paste actors:

- Make sure that the Scene Editor is active by clicking on its background.
- Choose **Edit > Paste**. Isadora will paste the actors that you cut or copied previously.
- The newly pasted actors will all be selected, so you can click on any one of them and drag to move them to a new location.

Making Links Between Actors

For Isadora's actors to work together, you must define the way in which the data moves from one actor to another. You do this by making links between the output of one actor and the input of another.

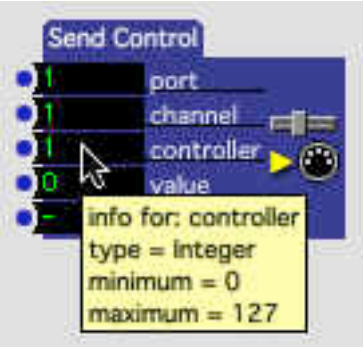
Property Types

Each property is of one of the following types:

Integer	Number, without Decimal Points
Float	Number, with Decimal Points
Boolean	Number, only 0 or 1 (often displayed as off or on)
Range	A pair of integers, specifying a range of values

Text	A text string
Trigger	Number, only 0 or 1 represented as – and X Whenever a new value arrives, the trigger “pulses”.
Video	A video stream
Sound	An audio stream

You can find out the type of a property by placing the mouse cursor over a property’s value edit box and then keeping it still for a moment. An information box will appear that shows the property’s name, type, and its minimum and maximum values.



You can connect any numeric or trigger output to any other numeric or trigger input. Video outputs can only be connected to video inputs, sound outputs to sound inputs.

To connect one actor!s output to another actor!s input:

- Click in an output port (the blue dot on the right side of an actor). A red line, representing the link, will now follow the movements of your mouse.
- Move to another actor’s input port (the blue dot on the *left* side of an actor). The link will thicken whenever you are inside of a valid input port. Note that you cannot connect video or sound outputs to numeric inputs, and vice-versa.
- Click the mouse to confirm the link.
- Note that the link is red when no data is flowing through the link, and that it is green when data is flowing.

To cancel a link in progress:

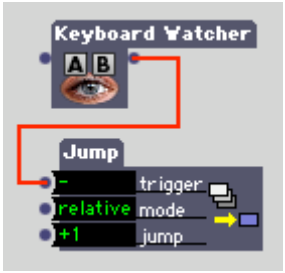
- Hit the *esc* key, or press Command-Period (MacOS) or Control-Period (Windows).
- Or, control-click (MacOS) or right-click (Windows) to choose “Cancel Link” from a popup menu.

To delete a link:

- Click on a link to select it. It will turn bright red or bright green (depending on whether or not there is data flowing through the link) to indicate that it has been selected. You can shift click to select more than one link at a time.
- Choose **Edit > Clear** to delete the link or press the *delete* key.

To segment Links for better visual organization:

You may want to organize your links visually so that you can better understand what your Scenes are doing when it contains several actors. You can do so by laying them out in segments. For example:



To create a link with segments:

- Start the process as before by clicking in an output port. The link will begin tracking your movements.
- As appropriate, click on the Scene Editor background. When you do, a new point will be added to the link. The red line now tracks from that point.
- Continue adding segments as desired. To finish the link, click in the input port of the target actor.

To move an existing Link segment:

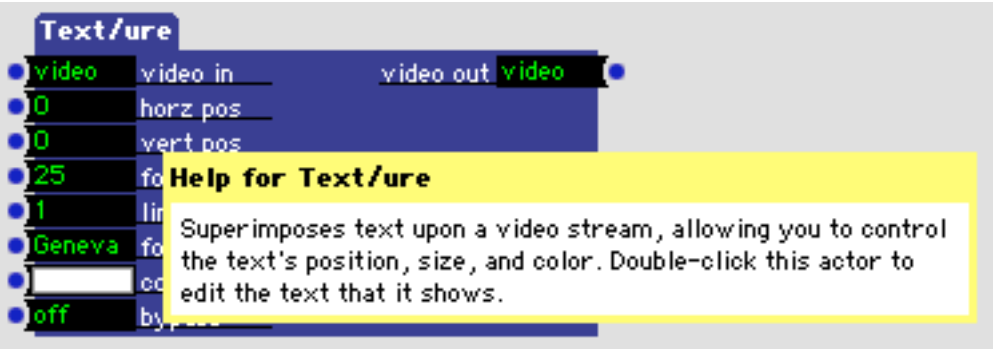
- Click in the link segment and drag. Horizontal segments can only be dragged up and down. Vertical segments can only be dragged horizontally.

Getting Help for an Actor

Each actor has built in help information. To display help for an actor, control-click (MacOS) or right-click (Windows) and choose “Actor Help…” from the popup menu. If you control or right click in an input or output, you can choose “Actor Input Help…” or “Actor Output Help…” to see specific information about that input or output.

To get help for an actor:

- Control-click (MacOS) or right-click (Windows) and choose “Actor Help…” from the popup menu. A small window will appear with the help information. Click anywhere to dismiss the help window.



To get help for an actor's property:

- Control-click (MacOS) or right-click (Windows) and choose "Actor Input Help…" or "Actor Output Help…" from the popup menu. A small window will appear with the help information. Click anywhere to dismiss the help window.

As a shortcut, you can also option click (MacOS) or alt click (Windows) an actor or its properties to show built in help information.

Navigating Inside the Scene Editor

In addition to using the scroll bars, you can use the mouse to drag the visible area of the Scene Editor up and down or left and right.

To scroll up or down, or left and right using the mouse:

- Hold down the command key (MacOS) or alt key (Windows) and click in the gray portion of the Scene Editor. The cursor will change into a "hand". While holding the mouse button down, drag the Scene Editor.

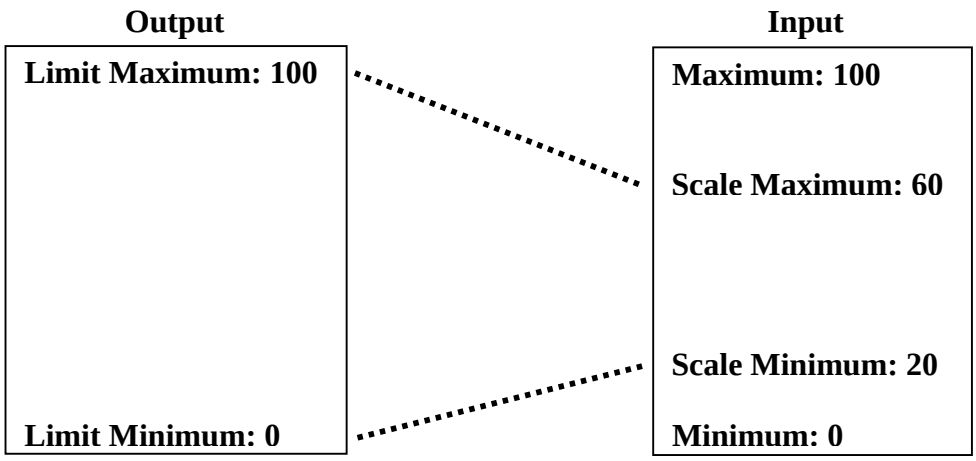
Scaling Values Between Outputs and Inputs

Whenever you link an actor's numeric output to another actor's numeric input, Isadora's default behavior is to scale the output's range of values so that they match the input's range of values.

Two pairs of values are used to calculate how values are scaled. Output properties have a *Limit Minimum* and *Limit Maximum* value that give the lowest and highest possible values that can be sent by that output property. Input properties have a *Scale Minimum* and *Scale Maximum* value that specifies the range to which any value arriving at that input will be scaled.

By changing these values for any pair of connected output and input properties, you can control the way that values are scaled as they move from output to input.

Here is an example:

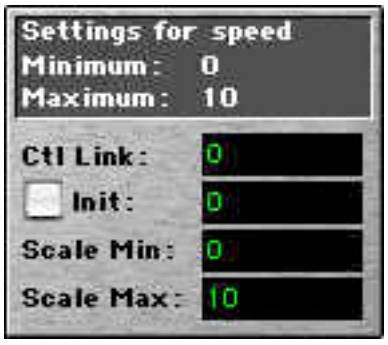


As the output property value on the left goes from 0 to 100, the input value will go from its Scale Minimum and Scale Maximum values, which have been set to 20 and 60 respectively. Thus, when the output property sends a value of 50 (halfway between 0 and 100) the value at the input will "see" the scaled of 40 (halfway between 20 and 60). You can also invert this relationship (e.g., Scale Minimum is 60 and Scale Maximum is 20) so that as the output value goes up, the input value will go down.

Whenever you add a new actor to a Scene, each input property's Scale Minimum and Scale Maximum values default to the absolute minimum and maximum value allowed by that property. Similarly, each output property's Limit Minimum and Limit Maximum also default to the absolute minimum and maximum.

To change the scaling of an input property:

- Click on the name of an input property, found just to the right of the input value box on the left side of an actor. The name will turn yellow to indicate that it is selected and an inspector with information about that property will appear.



At the top is the name of the input along with the absolute minimum and maximum values allowed for this property. Below are four value edit boxes: **Ctl**

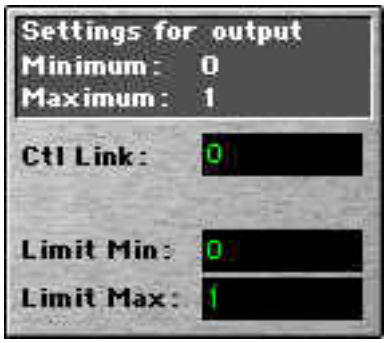
Link, **Init**, **Scale Min.** and **Scale Max**. (We'll discuss the "Init" box below, and the "Ctl Link" boxes in the section on Controls.)

The values of "Scale Min." and "Scale Max" determine the range of values to which any incoming value will be scaled.

- Change Scale Minimum and Scale Maximum values to specify the range of values to which values arriving at this input will be scaled. These value edit boxes work like the ones inside any actor – you can use the mouse to scroll through the possible values, or you can enter a value into the box by clicking on it, typing the value, and pressing *enter* or *return*.

To specify the limits of an output property:

- Click on the name of an output property, found just to the left of the output value box on the left right of an actor. The name will turn yellow to indicate that it is selected and information about that property will appear just below the Scene Editor.



- At the top is the name of the output along with the absolute minimum and maximum values allowed for this property. Below are three value edit boxes: **Ctl Link**, **Scale Min.** and **Scale Max**. (We'll discuss the "Ctl Link" value in the section on Controls.)
- The values of "Limit Min." and "Limit Max" determine the minimum and maximum values that the output will send, and are used in combination with the Scale Minimum and Scale Maximum input property values to determine how values will be scaled from an output to an input.
- Change Limit Minimum and Limit Maximum values to specify the lower and upper limit of values that can be sent by this property. These value edit boxes work like the ones inside of any actor – you can use the mouse to scroll through the possible values, or you can enter a value into the box by clicking on it, typing the value, and pressing *enter* or *return*.

To invert the relationship between and output and an input:

- If you want to invert the relationship between the output and the input so that as the output goes up the input goes down, set Scale Minimum to a value greater than Scale Maximum.

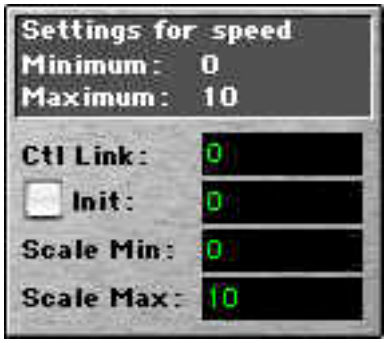
For example, if the output property ranges from 0 to 100, and its is connected to an input whose Scale Minimum is 100 and Scale Maximum is 0, then as the output property goes from 0 to 100 the input will go from 100 to 0.

Presetting a Property Value

There are situations when you may need to preset a property's value when its actor's Scene is activated. This is accomplished using the "Init" checkbox and value.

To mark a property value to be preset when its Scene is activated:

- Click on the name of an input property, found just to the right of the input value box on the left side of an actor. The name will turn yellow to indicate that it is selected and an inspector with information about that property will appear.



- At the top is the name of the input along with the absolute minimum and maximum values allowed for this property.
- Click in the checkbox to the left of the word "Init" to enable initialization. Then enter the value to which the property will be initialized in the value edit box to the right.

Editing Property Values

To change the value of one of the actor!s properties, do one of the following:

- Click on the value edit box (the black box next to the property's name) and drag the mouse up or down. The value will go up or down as you drag the mouse.
- Click in the value edit box. It will turn blue and the current value will disappear to indicate that you are about to type a value. Type the new value, and press *enter*.

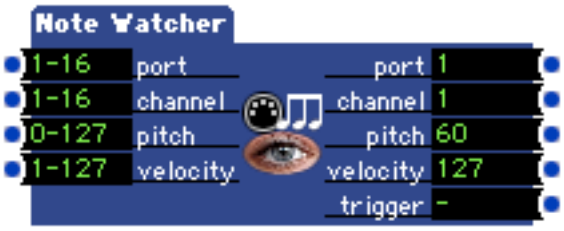
  Note that if the value you are editing is displayed as text (e.g., the wave type property of the Wave Generator, which can be set to sine, square, triangle, etc.) you can type the first few letters of the text and press *enter*. Isadora will find the value that most closely matches what you typed and enter it for you. (It is possible

that this feature may not be implemented on some third-party actors – if this is the case, you can always type a number, usually starting with 1 for the first item, to select the correct value.)

- Click in the input port (the blue dot) of a value. A combination slider/value edit box control will appear. You can edit the property's value by moving the slider's indicator up or down, or by typing into the value edit box. This feature is especially useful if you've collapsed the actor, as it is the only way you can change the value without first expanding the actor.

Collapsing/Expanding Actors

Each actor has three main components: the body (the rectangle on which the other elements sit), property value boxes, and the property value titles. The latter two can be shown or hidden independently, allowing you to make an actor much smaller. Here is how the Note Watcher actor looks in all of its possible states:



Standard

Titles Hidden

Values Hidden

Collapsed

To make one or more actors as small as possible:

- Select the actors you wish to collapse.
- Choose **Actors > Collapse**. Isadora will hide both the value edit boxes and property titles, making the actor as small as possible.

To restore one or more actors to its standard state:

- Select the actors you wish to restore.
- Choose **Actors > Expand**. Isadora will show both the value edit boxes and property titles, returning the actor to its normal state.

You may also hide or show the value edit boxes independently.

- To hide the value edit boxes of the currently selected actors, Choose **Actors > Hide Values**. Isadora will hide the value edit boxes of the selected actors. Choose **Actors > Show Values** to make the value edit boxes visible again.
- To hide the property titles of the currently selected actors, Choose **Actors > Hide Names**. Isadora will hide the property titles of the selected actors. Choose **Actors > Show Names** to make the property names visible again.

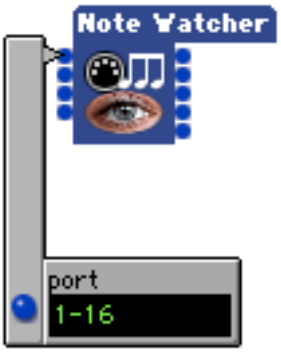
You can still edit any actor's input property value, even when its value edit boxes and property titles are no longer visible.

To see the title of a property when its actor is collapsed:

- Move the mouse over the input or output port (the blue dot.) The property's name will be displayed next to the mouse cursor:

To edit the value of an input property when its value edit boxes are not visible:

- Click in the input port of an actor. A combination slider/value edit box will appear, like this:



- You can edit the property's value by dragging the slider indicator (the blue ball) or by clicking in the value edit box and typing a new value.

To show or hide all actor names in a Scene:

- If the names are currently visible, choose **Actors > Hide Names** to hide them.
- If the names are currently hidden, choose **Actors > Show Names** to show them.

User Actors: Creating Your Own Actors

As you use Isadora, you will find that there are groupings of actors that you use often. Isadora's *User Actors* allow you to build your own actors from one or more Isadora actors.

Once you have identified a group of actors that you want to encapsulate into a User Actor, you can create one as follows: Add a User Actor to a Scene and open its editor by double clicking on it. Inside the editor, add the Isadora actors that define the function of this User Actor. Finally, add User Inputs and/or Outputs to bring data into, and send data out of, the new actor. When the actor is complete, close its editor window. The user actor now exists in your Scene, and can be copied, pasted and otherwise treated like any other Isadora actor.

Once a User Actor has been created, you can open its editor window at any time and change its functionality without disturbing the way in which the owning Scene operates.

User Actors are an advanced feature - you may want to review the User Actor tutorial in the Tutorials section to fully understand how they work.

Creating and Editing a User Actor

To add a User Actor:

- Select Toolbox Group 8/User Actors. Select the User actor by clicking on it, drag it into the Scene, and click again to deposit it. You will see an actor with no inputs and no outputs.

To edit a User Actor:

- To open a User Actor's editor window, double-click the User Actor. A new window will appear that looks like an Isadora document, except that there will be no Scene List across the bottom. The title of this window will have two parts, separated by a colon, indicating the owning document and the name of the user actor (e.g., "MyDocument : User Actor").

  In this editor you add Isadora actors, as well as User Input and User Output actors to define the functionality of your actor.

Adding Isadora Actors to a User Actor:

- To add an Isadora actor into a User Actor, click on the actor in the User Actor Editor's Toolbox, and deposit it into the User Actor's editor.

Creating and Editing User Inputs and Outputs

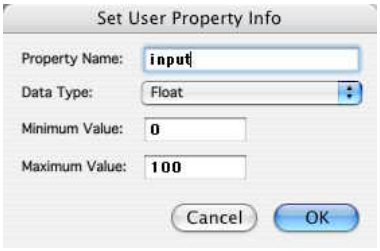
Adding inputs or outputs to a User Actor:

- In the User Actor Editor, select Toolbox Group 8/User Actors. There you will find the User Input and User Output actors.
- Drag a User Input and/or User Output to the Scene Editor and deposit it by clicking. They will look like this initially:

- After adding a User Input or User Output actor inside of the User Actor Editor, a corresponding input or output will appear as part of the User Actor that you are modifying.
- Important Note: At the moment you connect a User Input or User Output to another actor, all of the properties of the User Input or Output mutate to match the properties of the actor to which it was connected. This includes the Property Type (integer, float, video, etc.), Minimum and Maximum values, and the Scale Min/Max or Limit Min/Max values.

Setting input and output properties:

- Double-click the User Input or User Output actor. A dialog box will appear that allows you to define its characteristics:



- Set the name of this property, as it will appear in your User Actor, by typing the name into the “Property Name” text edit box.
- Set the data type using the “Data Type” pop-up menu. There are five possibilities:

1. Match Property
2. Integer – Whole numbers with no decimal point
3. Float – Numbers with a decimal point
4. Trigger – A trigger input
5. On/Off – An on or off (1 or 0) only input
6. Video – A video stream
7. Movie – A movie file number from the Media Window
8. Audio File – An audio file number from the Media Window
9. Picture File – A picture file number from the Media Window

10. MIDI File – A MIDI File number from the Media Window
11. 3D File – A 3D File number from the Media Window

The most common setting here is Match Property. When this option is selected, the user input or output will automatically adapt itself to match the characteristics of the input or output property to which it is connected. This setting ensures that the user input or output will match the property to which it is connected. (E.g., if you have a User Input, and you change the Scale Min or Scale Max of the property to which it is connected, the User Input's Scale Min and Scale Max will be updated to match.)

You can also choose Integer or Float. Doing so allows you to set the absolute minimum and maximum values for this property by entering those values into the "Minimum Value" and "Maximum Value" text edit fields. (Note: to use the lowest possible value for the selected Data Type, type MIN into the Minimum Value field. To specify the highest possible value, type MAX into the Maximum Value field.)

Like inputs and outputs on Isadora actors, this range of values limits the range of values that can enter this input, or that will be sent out of its output. Like any input or output, these limitations can be further constrained by changing the Limit Minimum, Limit Maximum, Scale Minimum and Scale Maximum values as appropriate.

- Click the OK button to confirm your settings.

Adding User Actors to the Global Toolbox

If you create a User Actor that you would like to use frequently, you can add it to the Global Toolbox. After you do so, the actor will appear in the User section of the Toolbox even after you quit and restart Isadora. You can drag this actor into the Scene Editor like you would any other.

You may also add an actor to the Local Toolbox. In this case, the user actor is stored along with your Isadora document. This feature may be useful if you create user actors that would only be needed within a particular file.

Choosing a Folder to Hold Your Global User Actors:

Before you can store any actors to the Global Toolbox, you must choose a folder to which they will be saved. This is the folder that Isadora will look in to find your user actors the next time it is started up.

- Choose **Actors > Set Global User Actor Folder**. A dialog will appear that allows you to select a folder.
- Click OK to confirm your selection.

To Add a User Actor to the Global Toolbox:

- Select the User Actor.

- Choose **Actors > User Actor To Global Toolbox**. The Toolbox will automatically switch to the User Actor Group and the new actor will be shown there.

You can only add a User Actor to the Global Toolbox if there is not an actor with that name already in the Toolbox. Isadora will warn you with an alert box if the name is already in use and you can choose to replace the actor or cancel. Otherwise, make sure actor names are visible, and then choose **Actors > Rename Actor**. A text edit box will appear. Type the new, unique name and press the Return key. Then follow the procedure above to add the User Actor.

To Add a User Actor to the Local Toolbox:

- Select the User Actor.
- Choose **Actors > User Actor To Local Toolbox**. The Toolbox will automatically switch to the User Actor Group and the new actor will appear be shown there.

You can only add a User Actor to the Local Toolbox if there is not an actor with that name already in the Toolbox. Isadora will warn you with an alert box if the name is already in use and you can choose to replace the actor or cancel. Otherwise, make sure actor names are visible, and then choose **Actors > Rename Actor**. A text edit box will appear. Type the new, unique name and press the Return key. Then follow the procedure above to add the User Actor.

To Remove a User Actor from the Toolbox:

- In the Toolbox, click on the User Actor you want to remove. At the top-right of the Toolbox, a small trashcan will appear.
- Move the cursor to the trash can – the cursor will change into a downward pointing arrow.
- Click on the trashcan. The User Actor will be removed from the Toolbox.

To Save an Individual User Actor to Disk:

You may want to share a User Actor with another Isadora user. To facilitate this, you can save an individual User Actor.

- Select the User Actor.
- Choose **Actors > Save User Actor...**. A save file dialog will appear.
- Using the file dialog, name your user actor and chose the place to which it will be saved. Then click OK.

To Bring a Saved User Actor into the Scene Editor:

If you have received a User Actor file and you would like to bring it into your document, use the “Place User Actor” command.

- Choose **Actors > Place User Actor...**. An open file dialog will appear.
- Select the User Actor file in the dialog.
- Click OK.

- The actor will appear in the Scene Editor as if you had just clicked on it from the Toolbox. Position the actor within the Scene window and click to deposit it.

Storing and Recalling Scenes with Snapshots

The Snapshots feature of Isadora allows you to memorize the current value of all of the input ports of all of the actors within a Scene. You can then use these snapshots to restore the actor's settings. This becomes useful when you want to create several variations of one scene and recall those settings later. The recall of Snapshots can be done either interactively or via operator input.

Taking a snapshot is as easy as clicking on the camera icon at the top left of the Scene Editor, or by choosing **Scenes > Take Snapshot**. As you take the snapshots, they appear to the right of the camera along the top edge of your Isadora document.

If you make changes to a scene and want to update a snapshot, you can do so by choosing **Scenes > Update Snapshot** or by holding down the control key and clicking the snapshot.

Note that once if you add more actors after you have taken one or more snapshots, the snapshots won't actually have enough information to restore the entire scene. To let you know that this is the case, if you add or paste actors into a Scene after taking one or more snapshots, a the snapshots will turn red to let you know that they are only partially valid, i.e., they don't have a total picture of the current scene.

If you take more Snapshots after this point, they won't be red. You can choose to delete all of the invalid snapshots by choosing the **Scenes > Clear Invalid Snapshots**.

Storing and Recalling Snapshots

To take a Snapshot of a Scene:

- Click on the camera, at the top left of the Scene Editor, or choose **Scenes > Take Snapshot**. After you do, an indicator with an identifying number will appear to the right of the Camera.

To recall a Snapshot of a Scene:

- Click in the Snapshot (the numbered circle) you want to recall.

To update the contents of a Snapshot:

- Click on the snapshot that you want to update to make it active.
- Choose **Scenes > Update Snapshot** or by holding down the control key and clicking the snapshot. A new snapshot of the current Scene will replace the old.

To Delete a Snapshot:

- Click on the Snapshot you want to delete and drag it above or below the Snapshots area. When you do, the cursor will change into a Trash Can.
- Release to mouse to delete the Snapshot.

To Delete Invalid Snapshots in a Scene:

- Choose **Scenes > Clear Invalid Snapshots**. All of the Snapshots with a slash in them will be deleted.

To Delete All Snapshots in a Scene:

- Choose **Scenes > Clear All Snapshots**. All of the Snapshots for the currently selected Scene will be deleted.

To Reorder Snapshots:

- Select one or more snapshots using the shift key.
- Click in one of the selected Snapshots, and drag the mouse to the right or to the left.
- As you drag, a white cursor will appear between the Snapshots. This shows where the Snapshots you are dragging will be inserted when you release the mouse. In the example below, the cursor is between scenes “5” and “6”.

- When the cursor is displayed at the location where you would like the Snapshots to be inserted, release the mouse button. The Snapshots will move to that location.

To Renumber Snapshots:

- Choose **Scenes > Renumber Snapshots**. All of the Snapshots will be renumbered starting from 1.

Using Control Panels

Overview

An Example Control Panel

The Control Panels feature of Isadora allows you to create a user interface for a Scene or group of Scenes. Each Control Panel communicates with the Actors inside the Scene(s) with which it is associated via a variety of Isadora Controls including Sliders, Buttons, Dials, etc. The Control Panel Editor occupies the same area as the Scene Editor – you toggle between the two views using **Controls > Show Controls** and **Controls > Hide Controls** menu commands. You may also see the Control Panel and the actors in the current Scene by choosing **Controls > Show Actor/Control Split**.

You can choose to have one Control Panel for an entire document, or to have several Control Panels, each associated with a group of one or more Scenes. Whenever a Scene is activated, its associated Control Panel is also activated, which in turn makes the controls for that panel visible.

Each control has one or more “Control IDs”, numbers that uniquely identify that control. To have an actor input “listen” to a particular control, you will set the Control ID Link for that input (accessed via a pop-up window that is shown when you click on the *title* of an input in the Scene Editor). From that point on, whenever the control is adjusted the actor input(s) to which it is linked will “hear” the values coming from the control. Similarly, it is possible to link an actor output to a control.

This can sometimes be useful if you want to monitor a output changing value in the control panel, e.g., by connecting the position output of the Movie Player to a Slider control.

A horizontal bar drawn below Scenes in the Scene List represents control Panels visually. The bar indicates the Scene or Scenes with which the Control Panel is associated. If a Control Panel is associated with two or more Scenes, the bar below those scenes will be unbroken.

Same Control Panel for All Scenes

Control Panel for Scenes One & Two, different Control Panel for Scene Three

Different Control Panels for Each Scene

It is important you understand that when editing a Control Panel associated with more than one Scene, that you are changing the panel for all of those Scenes.

You can create a separate Control Panel for a group of Scenes using the Split Control Panels command from the menu. The inverse can be accomplished by the Join Control Panels command.

Editing Scenes and Their Control Panels

The Control Panel associated with a Scene travels with that Scene when it is copied or cut. After a paste, Isadora will group all Control Panels that are the same, indicating that group by an unbroken bar below the scenes. Otherwise a gap will appear to show that there is a separate Control Panel.

Take a look at the following examples.

Select Scene Three and Cut

Paste Before Scene One

In the example above, Scene Three is cut and then pasted before Scene One. Since the Control Panel for Scene Three and Scene One were the same, the bar below the first three Scenes remains unbroken.

Select Scene Four and Cut

Paste After Scene One

Now, Scene Four is cut and then pasted after Scene One. Since the Control Panel for Scene Four is different than both Scene One and Scene Two, the bar is broken after Scene One and before Scene Two.

Communicating with Actors

The way in which a Control communicates with an Actor's property is through its Control ID. When you change a control's value, it sends its Control ID and value to the currently active Scene. Actor properties can be linked to a particular Control ID, so that if a message arrives from a controller the property will be set to the new value.

You can also choose to have the controller "listen" to the value of its linked property so that the controller always shows the current value of that property. This is useful if you need to have a controller show the current value of an input property, even though it is being changed by messages sent from another actor.

Creating/Deleting Control Panels using Split & Join

Since the Control Panels travel with the Scenes as you edit them, there are separate commands that allow you to create or delete a Control Panel. They are the Split Control Panel and Join Control Panel, respectively.

For both commands, you must first click in the space between two Scenes so that the blinking cursor appears.

If the Control Panel for the Scenes on either side of the blinking cursor is the same (i.e., an unbroken bar), the Split Control Panel command will be enabled. When you perform this command, the Control Panel for the Scenes to the left remains unchanged, while a new Control Panel is created for the Scenes to the right.

If the Control Panels for the Scenes on either side of the blinking cursor are different (i.e., a cursor is blinking between a broken bar) the Join Control Panels command will be enabled. When you perform this command, the Control Panel for the Scenes to the right are discarded, and the Control Panel for the Scene to the left now extends until the next Control Panel.

To create a new Control Panel for a group of Scenes:

- Click in the space just to the left of the Scene where you want the new Control Panel to appear. A blinking cursor will appear.
- Choose **Controls > Split Control Panels**. A new, empty control panel will be created and added to the Scene to the right. The bar between the two scenes will now be broken, indicating that they have two separate control panels. The Control Panel for the Scene to the left will be unchanged, while the Control Panel to the right will be empty.

To delete an existing Control Panel from a group of Scenes:

- Click in the space between Scenes where one Control Panel ends and the next begins (i.e., where the bar below the Scenes is broken.) A blinking cursor will appear.
- Choose **Controls > Join Control Panels**. The control panel to the right will be deleted. The bar between the two scenes will now be unbroken, indicating that they have one control panel. The Control Panel for the Scene to the left will be unchanged. The Control Panel to the right will has been deleted.

Showing/Hiding Control Panels

To see the currently active Control Panel:

- Choose **Controls > Show Controls**. The Control Toolbox and Control Panel Editor will appear, occupying the same area as the Actor Toolbox and Scene Editor.

Note that the Group Select buttons above the Actor Toolbox disappear, as there is only one group of controls. This gives you a clear indication that you are looking at a Control Panel editor, not a Scene Editor.

To see the currently active actors in the Scene Editor:

- Choose **Controls > Hide Controls**. The Control Toolbox and Control Panel Editor will reappear and the Scene Editor will replace the Control Panel Editor.

Using / Editing Control Panels

The Control Panels can be either in Edit Mode or Use Mode. When in edit mode, you can move the controls on the screen, change their size, and edit their settings. When in Use Mode, the controls are active and respond to mouse clicks as appropriate, i.e., clicking on a Slider control causes the indicator to move, changing the control's value. You can go between modes using the state with the **Edit Controls/Use Controls** menu item in the **Controls** Menu.

To Use Control Panels:

- Choose **Controls > Use Controls**. The Control Toolbox will disappear, and the Control Panel will expand to fill the entire Isadora document. The background of the Control Panel will change to give a further visual indication that it is in use.

To Edit Control Panels:

- Choose **Controls > Edit Controls**. The Control Panel's will move to the right, leaving enough room for the Control Toolbox, which will reappear to the left. The background of the Control Panel will change to give a further visual indication that it is in edit mode.

Adding New Controls to a Control Panel

The controls available in Isadora can be found in the Control Toolbox, which is located along the left side of an Isadora document.

To add a new control to a Control Panel:

- Click the control you want to add in the Toolbox. The cursor will change into a plus sign to let you know you have selected a control.
- Move the mouse into the Control Panel Editor. As you do, you will see the control you selected appear, following the movements of your mouse.
- Once you have the control in the position you desire, click the mouse to confirm its addition to the Control Panel.
- Note: You can click again the Toolbox or hit the Escape (esc) key to cancel the addition of the control.

Linking a Control to an Actor Input or Output

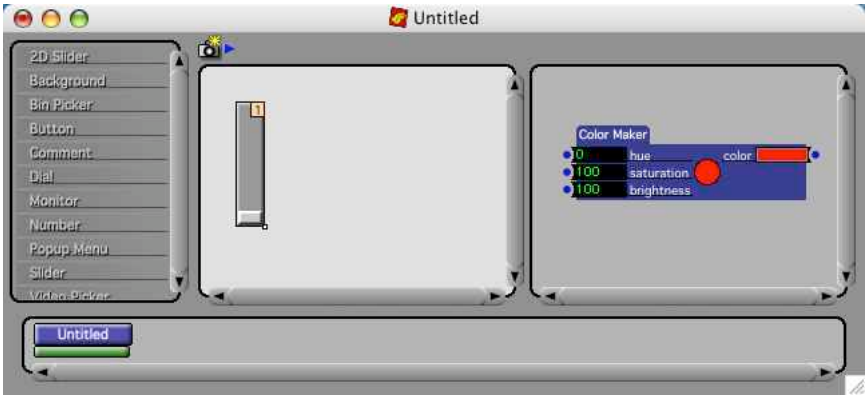
After laying out your controls, you will likely want to link those controls to properties of actors in the Scene(s) associated with your Control Panel. An actor property is linked to a control through its Control ID.

Whenever the value of a control changes, it broadcasts its Control ID and its new value to the currently active Scene. Any input properties linked to that control will change their value based on the new value of the control.

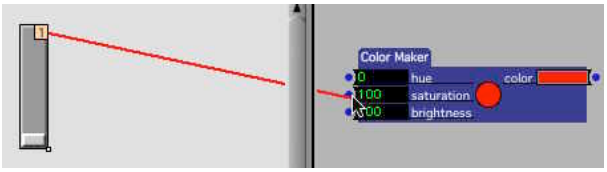
Conversely, whenever an output property is linked to a control and its value changes, the linked controls will change their value based on the output property's new value. This allows you to use controls as an output, displaying an output property's current value.

To link an Actor input property to a Control:

- Choose **Controls > Show Actor/Control Split**. When you do this, the Control Panel and the contents of the current Scene will both become visible as shown below.



- Click in the Control ID shown at the top right of the control, and drag the mouse. A red line will track your mouse as you do.



- Move the mouse to the input of the actor to which you want to link it and release the mouse.
- Once you have done this, a small “link indicator” will appear to the left of the input, showing the Control ID linked to that actor input.

  Once you see the link indicator, you know that whenever a control with that Control ID changes value, this input property will “see” that change, and automatically set its value appropriately.
- Note that if you want the control to track the value of the input property when it is changed by another actors or when you change it manually, you will need to turn on the “Show Value of Linked Input Properties” checkbox in the Control’s Settings Dialog.

Once you are done linking controls to actors, you can choose **Controls > Show Actor/Control Split** again to hide the actors and only show the Control Panel.

To link an Actor output property to a Control:

While controls are most commonly linked to actor inputs, sometimes you may want to link a control to an output, so that you can monitor some changing value in the Control Panel. To link a control to an actor output, do the following:

- If the Control Panel is not currently visible, choose **Controls > Show Controls**.

- Ensure that **Controls > Show Actor/Control Split** is turned on (has a checkmark.) If it does not, choose it now.
- Click in the Control ID shown at the top right of the control, and drag the mouse. A red line will track your mouse as you do.
- Move the mouse to the output of the actor to which you want to link it and release the mouse.
- Once you have done this, a small "link indicator" will appear to the right of the output, showing the Control ID linked to that output.

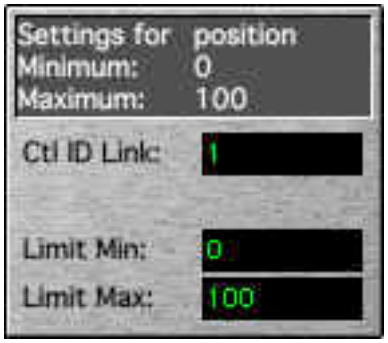
Once you see the link indicator, you know that whenever a control with that Control ID changes value, this input property will "see" that change, and automatically set its value appropriately.

- Note that if you want the control to track the value of the input property when it is changed by another actors or when you change it manually, you will need to turn on the "Show Value of Linked Input Properties" checkbox in the Control's Settings Dialog.

Unlinking a Control from an Actor Input or Output

To unlink an Actor input property to a Control:

- Click on the actor's input or output title. A small popup window will appear.



- Click on the value edit box to the right of Ctl ID Link. The edit box will turn blue to indicate that it is ready for you to type a number.
- Type the number 0 and hit return or enter. Once the Ctl ID Link is set to zero, it is no longer linked to any control.

Selecting and Deleting Controls

To select a control:

- Click on the control with the mouse.

To select multiple controls:

- Hold down the shift key while clicking on the controls you want to select.

To select a group of controls:

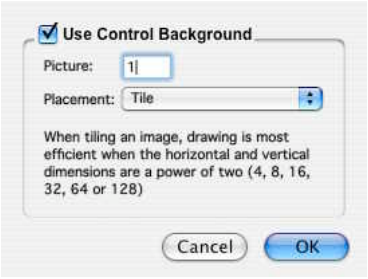
- Click on the Control Panel Editor's background, and drag the mouse. A selection rectangle will appear. When you release the mouse, any controls under the selection rectangle will be selected.
- If you hold down the shift key before you click, the controls under the selection rectangle will be added to the current selection.

Using a Picture as a Background (v1.1)

You can choose to fill the background of the Control Panel with a Picture in the Media Window. You may either draw the picture as is, tile it so that a small image fills the entire Control Panel, or scale the image to fit the control panel

To choose a background for a control panel:

- Choose **Controls > Set Control Panel Background…** The following dialog will be shown:


Use Control Background
Picture:
1
Placement:
Tile
When tiling an image, drawing is most efficient when the horizontal and vertical dimensions are a power of two (4, 8, 16, 32, 64 or 128)
Cancel
OK

- Check the **Use Control Background** checkbox to use a Picture as a background.
- In the **Picture** field, type the media index of a Picture in the Media Window. If the picture doesn't exist, a solid gray background will be used.
- Use the **Placement** popup to determine how the picture is drawn. Choose **Tile** to repeat the image over and over to create a continuous background. Choose **Top Left** to draw the image once, aligned to the top left of the control panel. Choose **Scale To Fit** to scale the image to match the size of the control panel.

IMPORTANT NOTE: If you choose the Tile option, it is very important that you use an image whose horizontal and vertical dimensions match one of the following values: 4, 8, 16, 32, 64, or 128. (The horizontal and vertical dimensions don't have to match each other, e.g., 16 x 64 is OK.) When the horizontal and vertical dimensions match one of these sizes, optimized routines are used to tile the background. If either dimension is not one of these values, drawing can be ***very slow*** –!especially for small images!

Positioning, Sizing and Aligning Controls

Isadora gives you several ways to organize and beautify your Control Panel. Beyond the normal dragging, you can

1) Use the arrow keys to precisely move or size your controls
2) Use the alignment commands to align and/or distribute your controls.
3) Lock controls in place so that they aren't moved accidentally during editing.

This section covers all of these editing features.

To move controls within the Control Panel Editor:

- Select one or more controls.
- Click on one of the selected controls and drag. The controls will follow the movements of your mouse until you release the mouse button, or
- You can also use the up, down, left or right arrow keys on your computer keyboard to move the controls. If grid snapping is on, they will move by one grid unit. Otherwise, they will move by one pixel.
- To move a control five units at a time, hold down the command key while pressing the arrow keys.

To change a control!s size:

- Click in its size box (the small right rectangle drawn to the bottom-right of the Control) and drag. The Control will resize as you drag, following the movements of your mouse.
- If you hold down the shift key and press one of the arrow keys, all selected controls will also resize. Shift-right-arrow makes the control wider, shift-left-arrow makes is thinner. Shift-down-arrow makes it taller, shift-up-arrow less tall. If grid snapping is on, they will resize by one grid unit each time you press the arrow key. Otherwise, they will change size by one pixel.
- Release the mouse when the desired size is set.

To align a group of controls:

- Select two or more controls.
- Choose **Controls > Align Left**, **Align Horizontal Center**, **Align Right**, **Align Top**, **Align Vertical Center**, or **Align Bottom** to align all specified edge of the selected controls

To distribute a group of controls evenly:

- Select two or more controls.
- Choose **Controls > Distribute Horizontally** or **Controls > Distribute Vertically** to distribute the selected controls in the specified direction.

To place controls in front of other controls:

- Select one or more controls.
- Choose **Controls > Bring to Front** to place all of the selected controls in front of other controls in the panel

To place controls behind other controls:

- Select one or more controls.
- Choose **Controls > Send to Back** to place all of the selected controls in behind of other controls in the panel

Editing Controls

To delete controls:

- Select one or more controls.
- Choose **Edit > Clear** or press the **Delete** key. Isadora will delete the selected controls.

To cut or copy controls:

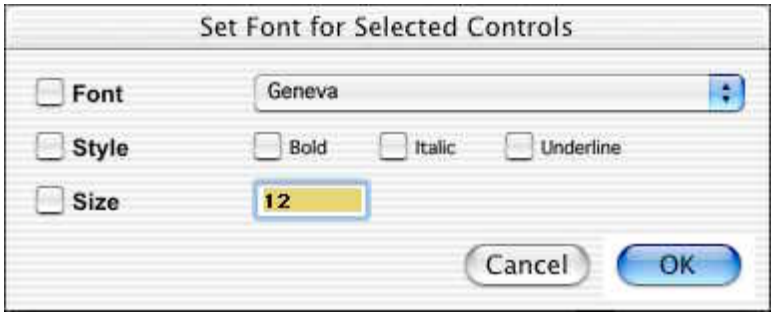
- Select one or more controls.
- Choose **Edit > Cut**. Isadora will cut the selected controls, or
- Choose **Edit > Copy**. Isadora will copy the selected controls.

To paste controls:

- Make sure that the Control Panel Editor is active by clicking on its background.
- Choose **Edit > Paste**. Isadora will paste the controls that you cut or copied previously, offsetting their position slightly from their original position.
- The newly pasted controls will all be selected, so you can click on any one of them and drag to move them to a new location.
- You can choose **Edit > Paste Over** to paste the controls without offsetting them from their original position. This can be useful if you want to use the arrow keys to move the new controls into position.

Setting the font, font style and font size for a group of controls:

- Select the controls
- Choose **Controls > Set Font for Selected Controls**. A dialog box will appear.



- To change the font, choose a new font from the pop up menu. When you do, the **Font** checkbox will automatically be checked.
- To change the typeface, check the **Bold**, **Italic**, or **Underline** checkboxes. When you do, the **Style** checkbox will automatically be checked.
- To change the size, type a number into the text box to the right of the **Size** checkbox. When you do, the **Size** checkbox will automatically be checked.
- If you decide you don't' want to change the font, style or size, uncheck the corresponding checkbox.
- Click OK. The font, style, and size of the selected controls will be changed as specified.

Locking Controls

You can also lock a control in place, so that they cannot be moved. This is especially useful when applied to the Background control, as you won't accidentally move the background as you place other controls on top of the background. Note however that you can still cut, copy, or paste locked controls.

To lock controls so they can!t be moved:

- Select one or more controls.
- Choose **Controls > Lock Selected Controls**. Note that the selection indicator (the blue border around the control) now changes to red for all locked controls. This gives you a clear visual indication that they are locked.

To unlock controls so they can be moved:

- Select one or more controls.
- Choose **Controls > Unlock Selected Controls**. Note that the selection indicator (the blue border around the control) now changes to blue for all unlocked controls. This gives you a clear visual indication that they are no longer locked.

Using the Grid Snap Feature

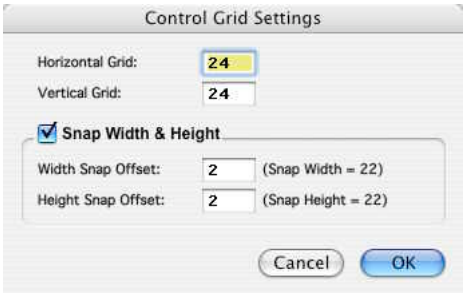
To help you organize your controls, the Control Panel Editor has a Grid Snap feature that allows you to define a grid to which controls will be aligned. You can tell if grid snapping is on or off by looking at the **Grid Snap On** item in the Controls menu – it will have a checkmark next to it if snapping is on.

To turn grid snapping on or off:

- Choose **Controls** > **Grid Snap On**. The grid snap feature will turn on if it was off or vice-versa.

To change the size of the grid:

- Choose **Controls** > **Edit Grid Settings**. The following dialog will appear:



The Horizontal Grid and Vertical Grid settings determine the grid to which the top-left corner of the control will be snapped.

If the Snap Width and Height checkbox is on, then the object's size will be snapped when you resize it. The Width Snap Offset and Height Snap Offset values are subtracted from the Horizontal and Vertical Grid values to determine the width and height to which controls will be snapped. The resulting width and height will be shown next to the Width Snap Offset and Height Snap Offset, respectively.

Changing a Control!s Settings

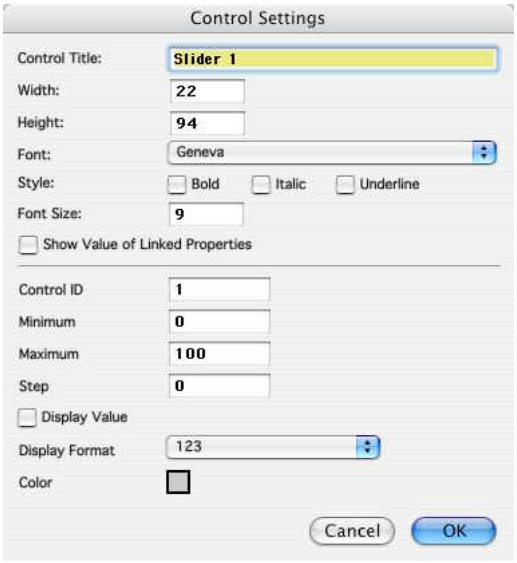
Each control has settings that determine its characteristics including its visual operation, mode of operation and, most importantly, its Control ID. The Control ID is used to identify the control when it broadcasts new values to actor properties to which it is linked.

The settings for each type of control vary. See the documentation in the Control Reference section for specific information about each control.

To edit a controller!s settings:

- Select the control and choose **Controls** > **Edit Control Settings…** or
- Double-click a control, or
- Control-click (MacOS) or right-click (Windows) the control and choose "Edit Control Settings…" from the popup menu.

  The control's settings dialog will appear. Here is the Control Settings Dialog for the "Slider" control:



The items above the separator line (Control Title, Width, Height, Font Settings, and the Show Value of Linked Inputs check box) are common to all controls. Items below the separator are specific to the type of control whose settings are being edited.

The Control ID will be in the lower section. This number is important because its value is used to identify the controls to which they are linked. Most controls have one Control ID. Some have more than one – a few (notably the Comment control) have none.

- Once the settings are as you desire, click the OK button to confirm your changes.

Setting Control Specific Options

Some controls have options that cannot be edited in the Control Settings dialog (e.g., the Video Picker.) You can access these settings by choosing the Control Specific Options dialog. Each dialog is specific to the control, so you should refer to the specific documentation in the Controls Reference chapter for more information.

To edit a Control Specific Options:

- Select the control and choose **Controls > Control Specific Options…**

  The control's options dialog will appear. Please refer to the documentation for the specific control for more information.

Seeing the Control ID Associated with Controls

While editing, you can choose to show the Control IDs associated with the controls shown in the Control Panel Editor.

To show the Control IDs used by a control:

- Choose **Controls** > **Show Control IDs**. The Control ID will appear in a small rectangle located at the top right of the control.

To hide the Control IDs used by a control:

- Choose **Controls** > **Hide Control IDs**.

Using FreeFrame Plugins

Isadora supports FreeFrame, an evolving video plugin standard for MacOS and Windows. (You can find out more about FreeFrame at their home page – http://freeframe.sourceforge.net/)

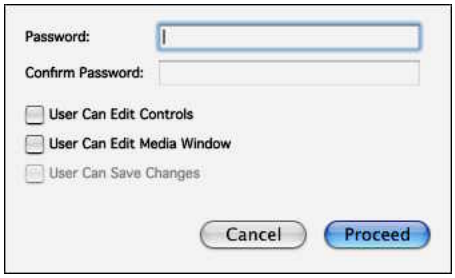
Isadora looks for FreeFrame plugins in a standard location. The FreeFrame development community has agreed upon standard locations where application programs should search for FreeFrame Plugins. On MacOS, you should place the plugins in /Library/Application Support/FreeFrame; on Windows you should place them in C:\Program Files\Common Files\FreeFrame. (You may need to create these folders – they don't normally exist by default.) You can however choose a different directory in the **Video** tab of the **Preferences** – see Page 108 for more information.

Saving Files as Run-Only (v1.1)

Isadora now allows you to save your files as "run-only", so that others can use the file but can modify in specific ways. One place this might be useful is when Isadora is used to create installations that will be maintained by others. Making a document run-only means that only you will be able to modify the file.

To save a file as Run-Only:

- Choose **File** > **Save As Read Only…** The following dialog will appear:



- Type the password for this file into both the **Password** and **Confirm Password** fields.
- Choose what users opening this document may edit. Choosing **User Can Edit Controls** means that the user can modify the Control Panels of your document. Choosing **User Can Edit Media Window** means that the user will be able to import media into the Media Window. Finally, choosing **User Can Save**

Changes means that the user can save any changes that they make if they have a registered version of Isadora.

- Click OK to confirm your choices.

At this point, Isadora will ask you to save the file, so that it will be saved on disk with the password protection enabled. Once you've done this, the document will open in the run-only mode you specified. To edit it, you will need to unlock it using the **File > Unlock Document…** command.

To unlock a Run-Only file so that you can edit it:

- Choose **File > Unlock Document…** The following dialog will appear:

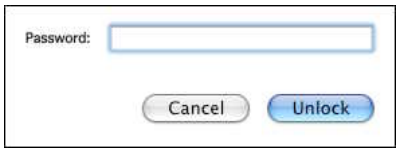
- Type the password into the **Password** field and click **Unlock** to unlock the document so that it can be edited.

To lock a previously unlocked document

- Choose **File > Lock Document…** The document will return to locked mode.

To remove the password from a Run-Only document

- Choose **File > Remove Password…** The following dialog will appear



- Type the password into the **Password** field and click **Unlock** to unlock the document and remove the password protection from it.

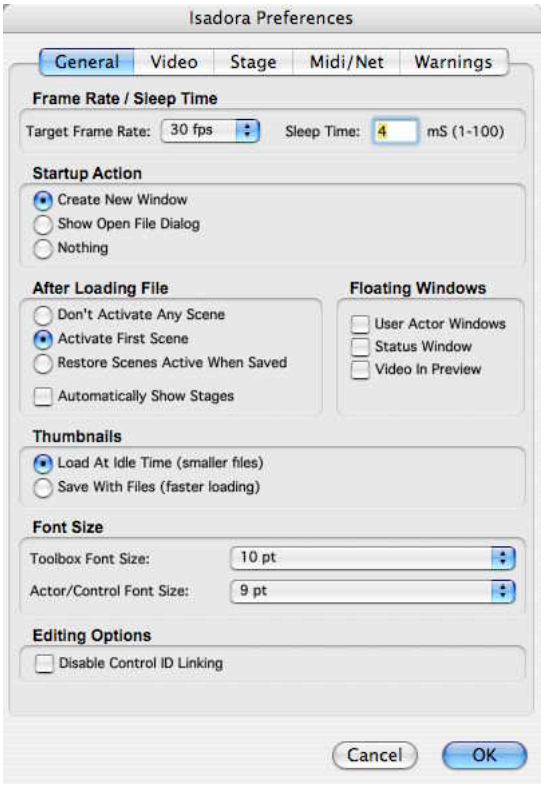
At this point, Isadora will ask you to save the file, so that it will be saved on disk with the password protection disabled. Once you've done this, the document will open without any restrictions on what other users can do with it.

Setting Preferences

To edit Isadora's preferences, choose **Edit > Preferences…**

There are three sections in the Preferences window, General, Stage, and Alerts. Each section can be selected by clicking the appropriate tab at the top of the window.

General Preferences



Frame Rate / Sleep Time (v1.1)

The Target Frame Rate popup allows you to specify the rate at which Isadora will attempt to render its video output. This value relates directly to the FPS display in the Status Window.

The Sleep Time setting specifies how much time Isadora will give to other processes running on your computer. Specifically, it specifies the period, in milliseconds, with which Isadora will attempt to service the active scene(s). A setting of 4 would mean that Isadora would attempt to service the active scenes every 4ms, or 250 times a second. This setting relates directly to the Cycles setting in the Status Window.

Setting this to a lower number may make Isadora run faster, but will slow down other programs running on your computer. Setting this to a higher number will give more time to other applications, but may make Isadora run poorly. Experiment with a few values to see what works best for you – a good range is somewhere between 2 and 15.

Startup Action

You can choose what action Isadora will take when the program starts up. There are three options:

- Create New Window – Creates a new empty window on startup

- Show Open File Dialog – Shows the open file dialog and asks you to open a file on startup.
- Nothing – Does nothing on startup.

Click the radio button for the desired option.

After Loading File

You can choose whether or not Isadora will activate a Scene when a file is loaded. There are three options

- Don't Activate Any Scene – After loading a file, no Scene is activated. You must activate the first scene manually.
- Activate First Scene – After loading a file, activate the first Scene in the Scene List.
- Restore Scene Active When File Was Saved – After loading a file, activate the Scene that was active at the time the file was saved.

Click the radio button for the desired option.

You can also choose to automatically show the Stage window(s) after loading the file. Check the "Automatically Show Stages": checkbox to enable this feature.

Floating Windows

This selection allows you to specify which of windows will be "normal" windows, which go behind other windows when deactivated, and which will be "floating" windows, which always stay on top.

- User Actor Windows: check this box to make User Actor Editing windows floating windows.
- Status Window: check this box to make the Status window a floating window.
- Video In Preview: check this box to make the Video In Preview window a floating window.

Thumbnails

You can choose whether or not Isadora will store thumbnails for the movies and pictures imported in the Media Window with your Isadora documents. If you don't choose to store the thumbnails, Isadora creates them when the document is loaded, which can be time consuming if you have of lots of media. Choosing to store the thumbnails with the document results in larger files but ensures that Isadora won't spend time creating thumbnails after the file is loaded.

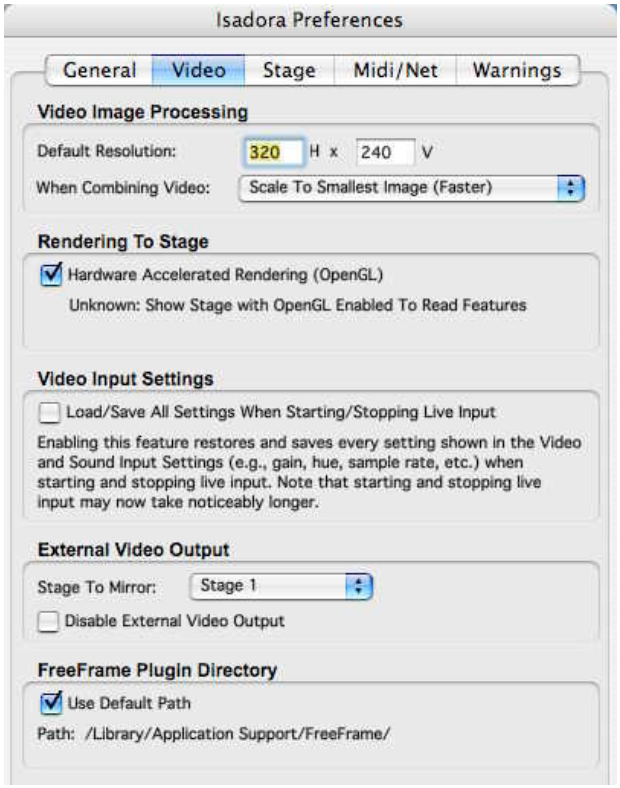
Font Size

These pop-up menus allow you to choose the font size for the Actor Toolbox and for the Actors displayed in the Scene Editor.

Editing Options

Here you can enable or disable the Control ID Linking feature available when you enable the Control Panel / Scene Editor Split feature.

Video Preferences


Isadora Preferences
General
Video
Stage
Midi/Net
Warnings
Video Image Processing
Default Resolution:
320
H x
240
V
When Combining Video:
Scale To Smallest Image (Faster)
Rendering To Stage
Hardware Accelerated Rendering (OpenGL)
Unknown: Show Stage with OpenGL Enabled To Read Features
Video Input Settings
Load/Save All Settings When Starting/Stopping Live Input
Enabling this feature restores and saves every setting shown in the Video and Sound Input Settings (e.g., gain, hue, sample rate, etc.) when starting and stopping live input. Note that starting and stopping live input may now take noticeably longer.
External Video Output
Stage To Mirror:
Stage 1
Disable External Video Output
FreeFrame Plugin Directory
Use Default Path
Path: /Library/Application Support/FreeFrame/

Default Resolution (v1.1)

This specifies the default horizontal and vertical resolution used by Isadora when processing video streams.

Isadora won't change the resolution of two video images when their resolution and format are the same. In that case, this setting has no effect: the scaling of the **When Combining Video** setting (described below) controls how the two video streams are scaled.

However, this setting is important when working with an actor whose video inputs provide a default, black video stream when left unconnected. (E.g., the Video Mixer actor.) In that case, the resolution of the black buffer is set to the default resolution. This can affect the resolution of an actor's final output.

When Combining Video Popup

These settings how Isadora combines processes video as it flows through the program.

The **When Combining Video** popup menu determines how video images of differing sizes will be combined when they are processed by a single actor.

- Scale To Largest – When this option is chosen Isadora will combine video images that are of different sizes by scaling the smaller images up to match the size of the largest image. This results in slower performance but better resolution.
- Scale To Smallest – When this option is chosen Isadora will combine video images that are of different sizes by scaling the larger image down to match the size of the smaller image. This results in faster performance but lower resolution.
- Scale To Preferred Resolution – When this option is chosen, Isadora will scale all video images to the default resolution specified above. If you want to speed up video processing, make this a smaller value (i.e., 160 x 120).

Rendering To Stage (v1.1)

When the "Hardware Accelerated Rendering" checkbox is enabled, Isadora will attempt to use OpenGL – software that communicates directly with your computer's graphics card – to render video to the Stage. This results in significant speed increases on most modern computers and produces better looking output. You should only uncheck this box if the Hardware Acceleration feature is causing trouble on your computer.

Video Input Settings (v1.1)

Some video cameras, notably the iSight on MacOS, have a number of settings that are not normally remembered after you disable live video input in the Input menu. If you would like Isadora to retain all of the settings associated with the camera, you can enable the **Load/Save All Settings when Starting/Stopping Live Input** checkbox. Note that, if you do this, it is likely that starting up live input will take noticeably longer than when this option is not enabled. If you are using the Capture Control actor to enable/disable Live Input programmatically, this may cause notable freezes in the video output, sound drop outs, etc.

External Video Output (v1.1 – MacOS X Only)

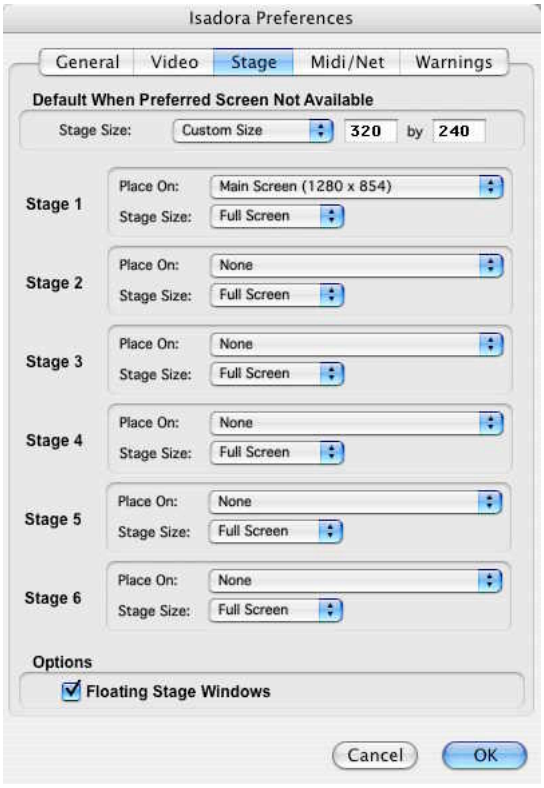
Isadora now has the capability to mirror one of its Stages to a FireWire camera or a video card. (See on Page 135 for more information on this feature.) Choose the stage that to be mirrored when External Output is enabled here. You can also choose to disable the external output feature entirely –!this is important if you plan to use the DV Device Control actor, because this feature is disabled when the External Video Output is enabled.

FreeFrame Plugin Directory (v1.1)

Isadora now looks for FreeFrame plugins in the /Library/Application Support/FreeFrame on MacOS, or the C:\Program Files\Common Files\FreeFrame on Windows. The FreeFrame development community has agreed upon these directories as the standard place for application programs to search for FreeFrame Plugins.

You can choose to have Isadora look in a different folder however. Choose **Isadora > Preferences** (MacOS) or **Edit > Preferences** (Windows) and click on the **Video** tab. In the section marked **FreeFrame Plugin Directory**, uncheck the **Use Default Path** checkbox. When you do, a folder selection dialog box will appear. Choose the folder where you'd like Isadora to look for plugins, and click OK. The next time you start up Isadora, it will look in the specified folder for FreeFrame plugins.

Stage Preferences



Isadora supports up to six video output channels, called *Stages*. The Stage Settings section of the Preferences window allows you to set the screen (i.e., monitor output) on which a stage will appear when it is shown.

Stage 1, 2, 3, 4, 5 & 6 (v1.1)

Under the areas labeled Stage 1 through Stage 6 you will find a popup menu labeled "Place On" and "Stage Size."

Use "Place On" to specify the screen on your computer on which that Stage will appear when shown.

If a screen is currently available on the computer, its dimensions will appear next to the name in the "Place On" popup menu (e.g., "Screen 2 (640 x 480)"). You may also select "None" if you don't want a Stage to be visible on that screen. In the popup menu labeled "Stage Size" you can choose whether the stage will entirely fill the screen, or whether it will be set to a custom size defined by you. If you choose

the custom size option, edit boxes will appear that allow you to set the horizontal and vertical dimensions (in pixels) that will be used when the stage is shown.

On computers with more than one screen, you would generally set Stage 1 to appear on Screen 2, Stage 2 to appear on Screen 3, etc., and choose the "Full Screen" stage size. That way, you can edit your Isadora document on the main screen and show the output on the other screens. If you only have only one screen, you would typically place Stage 1 on Screen 1, and set the other "Place On" popup menus to "None." If you are editing patches on a computer with one screen, you may want to turn on the Custom Size option so that the Stage(s) appear at a smaller size – this will allow you to see the editing window and the stages at the same time.

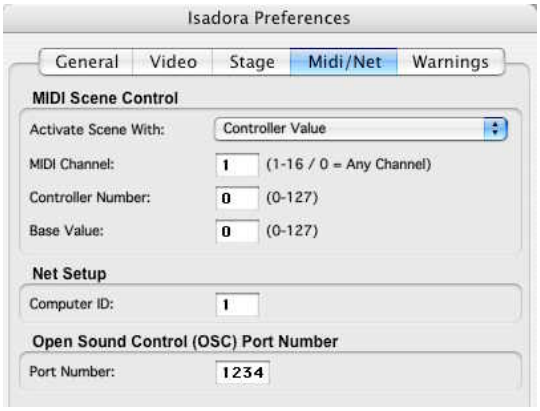
Default When Preferred Screen Not Available

At the top of the window you will see an area labeled "Default When Preferred Stage Not Available." These will determine how a stage is displayed if the screen you have chosen in "Place On" is not available when you chose the **Windows > Show Stages** menu command.

Floating Stage Windows

If you would like your Stage windows to "float" (i.e., to always be in front of the Isadora document), check this box.

MIDI/Net Preferences



MIDI Scene Control

In this section, can choose to allow MIDI message to activate Scenes. When this option is turned on, and when the proper MIDI message arrives, it will cause one of a Scene to be activated in the same way it would be if you clicked on that Scene with the mouse.

You specify which MIDI message will activate the Scenes using the Activate Scene With popup. The choices are:

- None – Don't use MIDI commands to activate scenes
- Program Change.

- Continuous Control
- Note On
- Note Off

If you choose the Program Change, Note On, or Note Off choices, the area below the popup will have two settings: the MIDI Channel and Base Value.

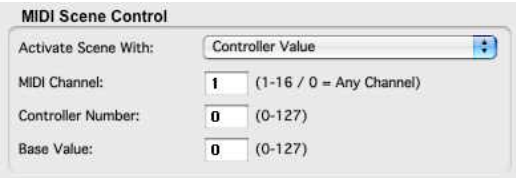
The MIDI Channel specifies what MIDI Channel the message must arrive on to cause the activation of a Scene. If a message arrives and its MIDI channel does not match the one specified here, it will not activate the Scene. You can choose 0 to allow messages on any channel to work.

The Base Value specifies message value that will activate the first Scene. This is interpreted differently for each message type:

Message Type	Message Value
Program Change	Program Change Number
Continuous Control	Controller Value
Note On	Pitch
Note Off	Pitch

If Isadora sees a MIDI message of the proper type on the specified MIDI Channel, and its value matches the one specified in the Base Value field, Isadora will activate the first Scene. If the value is greater than the Base Value, Isadora will activate a subsequent Scene if it is available. For example, if Isadora were looking for Program Change messages with a Base Value of 5, then MIDI program change 5 would activate the first scene; program change 6 would activate the second, etc.

If you choose to activate Scenes using the Continuous Controller messages, the MIDI Controller Number field will appear.



For Continuous Control messages, Isadora checks the message's Controller Number in along with the MIDI Channel and Base Value. If the controller number does not match the one specified by the Controller Number field, the message is ignored.

Net Setup

Here you specify a number that identifies this computer when multiple copies of Isadora communicate with each other over a Local Area Network. The Net Broadcaster actor specifies which computer will receive a given message using this number – see the Net Broadcaster actor for more information.

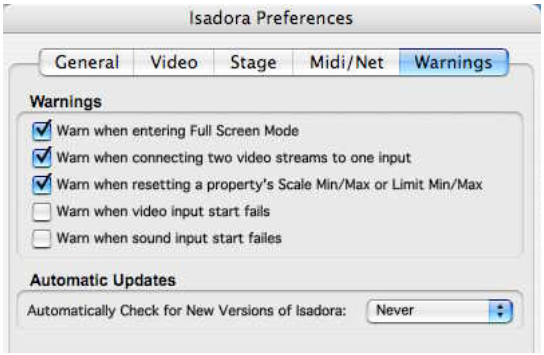
Open Sound Control (OSC) Port Number (v1.1)

If you are using Open Sound Control (OSC) to receive messages from another computer (or another program running on your computer), you may need to set the OSC port number. The other application needs to know two pieces of information when transmitting OSC messages to Isadora via UDP: your computer's IP address, and the port number. Normally, you can set the port number in the other application. But, in some cases, it may be necessary to change Isadora's port number to match the other application.

Once you change this value, you will need to quit and restart Isadora before the change will take affect.

For more information on Open Sound Control support, see Page 139.

Warnings



To help new users avoid common problems, Isadora shows warning messages when certain actions are taken. When these warnings appear, you have the option of continuing with the operation, canceling the operation, or choosing "Don't Show Again" to continue with the operation and to prevent the warning from appearing again in the future. Choosing "Don't' Show Again" has the side effect of "unchecking" the corresponding checkbox in the Warnings section of the Preferences.

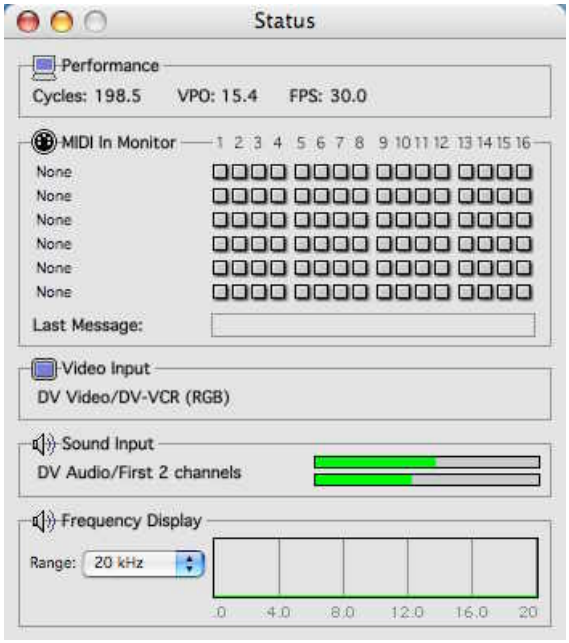
Note that the **Warn when video input start fails** and **Warn when sound input start fails** boxes are unchecked by default. This is to prevent these errors from stopping operation of a Scene, especially when using the Capture Control actor to enable live input programmatically.

You can enable the warnings again by checking the appropriate box in this section of the Preferences window.

Status Window: Monitoring Performance and External Input

The Status Window exists to give you information about data arriving into Isadora from the outside world, about external devices connected to Isadora, and about Isadora's performance.

To see the Status Window, choose **Windows > Show Status**. You will see a window that looks something like this:



There are six sections: Performance, MIDI In Monitor, and Video Input, Sound Input, Frequency Display and DV Devices. The Performance and MIDI In Monitor sections are always visible. The other sections may or may not be visible if your computer does not have the appropriate hardware or drivers.

Performance

This section tells you Isadora's Cycle Rate, Video Processing Overhead, and Frame Rate

The Cycles display tells you how many times per second Isadora can process all of the actors in the currently active Scene(s). The higher this number, the better Isadora's performance. This maximum value of this number is directly related to the Sleep Time setting in the General tab of the Preferences –!lower sleep time values will yield a higher number of cycles per second.

VPO stands for Video Processing Overhead. This value, given as a percentage of total processor usage, indicates how much time is being used by the video processing actors in the active Scene. As this number gets larger, Isadora will run more slowly and your frame rates will go down.

FPS shows the current output frame rate of the stage. Isadora always attempts to render video frames at the rate set in the Target Frame Rate of the General tab of the Preferences. If the patch is complex and/or has numerous video effects, this value may not reach the target set in the Preferences.

Midi In Monitor

This section has a series of indicators for each MIDI Source Port (as set up using the MIDI Setup dialog.) Whenever a MIDI message arrives on a given Source Port, the indicator with the corresponding MIDI Channel will illuminate briefly. If the message is a System Exclusive message, then the indicator marked SX will illuminate.

In addition, each time a message is received, specific information about that message will appear in the area marked Last Message.

Video Input

When you are capturing audio (i.e., **Start Video + Sound Input** or **Start Video Input** have been chosen from the Capture menu), the Video Input panel displays the name of the video input device that is being captured as well as the video format (RGB or YUV) that is being decoded.

Sound Input

When you are capturing audio (i.e., **Start Video + Sound Input** or **Start Audio Input** have been chosen from the Capture menu), the Sound Input panel displays the name of the audio input from which the sound is being captured along with a "VU" meter that allows you to monitor the current input volume. See the Sound Level Watcher actor to find out how to use the sound input volume to control other actors.

Frequency Display

If you are capturing audio *and* the "Sound Frequency Analysis" item in the Capture menu has a check mark, you will also see the "Frequency Display" panel. Here you can see a real-time display of the frequency spectrum of the sound coming into the computer. If **Sound Frequency Analysis** is not enabled, choose **Input > Sound Frequency Analysis** to enable it.

There is also a pop-up menu that allows you to choose the maximum frequency of this display. This is particularly useful if you are trying to determine the frequency spectrum of a particular sound and need a finer resolution in the lower end of the spectrum.

See the **Sound Frequency Watcher** actor on Page 275 to find out how to use the frequency spectrum of the live sound input to control other actors.

DV Devices

If you connect digital video cameras or other devices that allows transport control via your computer's Fire Wire port, then those devices will appear here. It will report the device's unit ID, its name, its status and the current frame number of its media (if available.)

When you see a device here, you will be able to control it using the DV Device Control actor. Use the unit ID shown here to identify which device you wish to control with the DV Device Control actor.

Cue Sheets

Isadora has an integrated Cue Sheet feature that is useful when you are creating a performance that is linear, e.g., a play that goes from the one scene to the next. This feature allows you to trigger events in Isadora while simultaneously displaying text to an operator to prepare them to take the next cue.

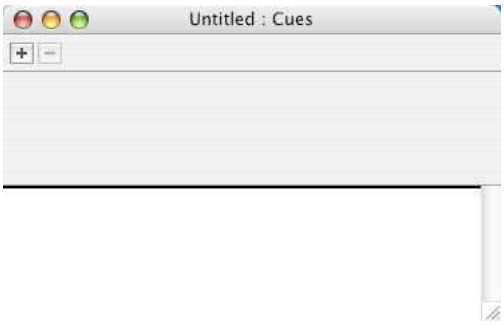
The cue sheet works by simulating key presses on the computer keyboard. Whenever the operator triggers a cue, the specified character is sent to all Keyboard Watcher actors in the current Scene. By setting the Keyboard Watcher to look for a specific key coming from the Cue Sheet, you can trigger actions in response to the operator executing a cue.

Creating The Cue Sheet

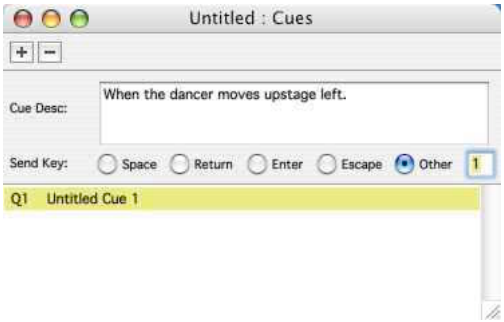
Each Scene has its own set of cues. You access the cues for a particular scene by clicking on the Scene to activate it.

To add a new cue:

- Activate the Scene whose cues you wish to edit.
- Choose **Windows > Show Cue Sheet Editor…** to show the Cue Editor window. Initially, it will look like this:



- Click the Plus Sign (+) to add a new cue. After you do, fields will appear that allow you to edit that cue.



- Next to the prompt you can type the text that will be shown to the operator. Generally this will describe something that is happening on stage, which will cause them to execute the cue.
- To the right of the "Send Key" prompt, you can choose the character that will be sent to Isadora Keyboard Watcher actor. Using the radio buttons, you may choose from the **Space Bar, Return Key**, **Enter Key**, **Escape Key**, or **Other**. If you choose **Other**, then you need to enter the character you want to be sent in the text field to the right of the Other radio button.

To edit an existing cue:

- Select the cue from the list located in the bottom portion of the Cue Editor window.
- Edit the **Cue Desc** field and **Send Key** radio buttons shown in the top portion of the Window.

To remove cues:

- Select the cue(s) in the list located in the bottom portion of the Cue Editor window.
- Click the minus button (-), or press the delete key, or choose **Edit > Clear** to delete the cue. Or choose **Edit > Cut** to cut the cue so that it can be pasted into another location the list.

To paste cues:

- Click between two cues to set the blinking insertion point. This is where the cue(s) will be inserted when you paste.
- Choose **Edit > Paste**

To change the order of cues:

- Select the cue(s) in the list located in the bottom portion of the Cue Editor window.
- Drag them to a new location – the blinking insertion point shows where the cues will be inserted.
- Release the mouse button

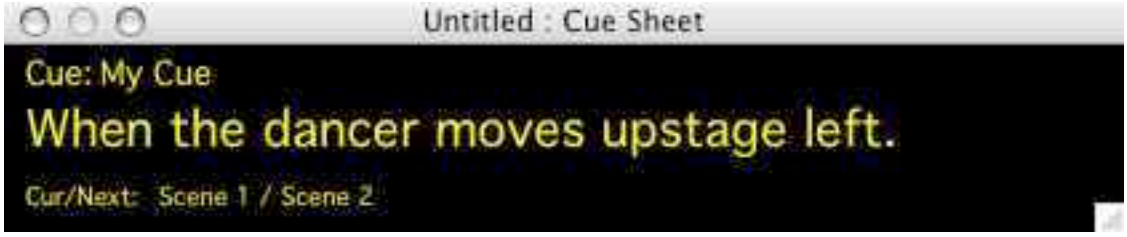
To change the name of the cue itself:

- Option-click (MacOS) or Alt-click (Windows) the cue in the list located in the bottom portion of the Cue Editor window.
- A text edit field will appear showing the current name of the cue.
- Type the new name of the cue
- Hit the return key to confirm the edit.

Using the Cue Sheet

Once the cue sheet has been created for each scene, you are ready to use the Cue Sheet feature. Start by activating the first scene in the Isadora document. Then do the following:

- Choose **Windows > Show Cue Sheet** to show the cue sheet to the operator. It will look like this:



- To execute a cue, hold down the Control key and press the Space Bar. When you do, Isadora will simulate pressing a key on the computer keyboard, as defined for this particular cue in the Cue Editor window. It will then immediately show the next cue.

For example, for example the cue above (When the dancer moves upstage left) the **Other** radio button had been selected and the Send Key set to '1'. Upon holding down the Control key and pressing the Space Bar, Isadora would simulate pressing the number '1' on the computer keyboard. Any Keyboard Watcher actors in the current scene set to watch for the key '1' would send a trigger, thus allowing you to trigger a specific action when this cue is executed.

Input and Output

Pausing and Resuming the Isadora Engine

It is possible to create a patch that will never let you edit it again. For example, connecting the Enter Scene Trigger actor to the Jump actor would cause a jump to another scene as soon as the scene is activated.

The **Pause Engine** and **Resume Engine** commands in the Output menu can help you in just such a circumstance. To edit a scene, regardless of how it is programmed, choose **Output > Pause Engine** and then activate the scene by clicking on it. When in this mode, all of Isadora's internal timers and messaging are disabled. As such, actors like Enter Scene Trigger will never be activated, Movies will not play, and so on. Because of this, it is impossible to exit the scene because of the way in which it is programmed.

After you have edited the Scene to your satisfaction, choose **Output > Resume Engine** to return to normal use.

Enabling Live Video & Audio Input

To bring live video into Isadora, you must have hardware that allows Isadora to "see" the video coming into your computer. On contemporary Macintoshes the Fire Wire input is the most ubiquitous way to input video. (Fire Wire, aka iLink or IEEE1484, is also becoming common on Windows machines.) In addition, there are various capture boards, PC Cards (for laptops), USB video capture devices, etc. Any of these can be used with Isadora as long as you have installed drivers that allow them to be seen by QuickTime.

It is the reverse case for audio capture. Most Windows machines have an external audio input. Several contemporary Macintosh models do not have audio input built in, though you can use an external USB Audio Input device like the Griffin iMic to bring sound in to the computer

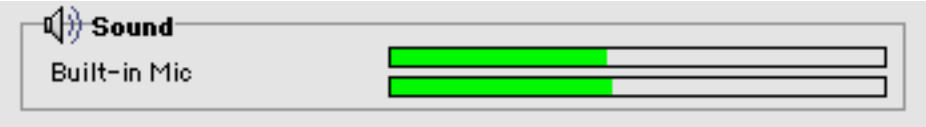
On the Macintosh, almost every video card or other hardware provides drivers that allow video capture via QuickTime. On Windows machines, this is less common, though those computers with a Fire Wire input will be able to use the freely available WinVDIG driver to ensure that they can capture video. (You can download WinVDIG from http://www.vdig.org)

When using capture boards or other external video capture hardware, the installation procedure varies from vendor to vendor. Follow their instructions to install the video input hardware on your system.

Once all of the necessary drivers and hardware are installed, perform the following steps to begin capturing live video.

- To capture live video, start by connecting your video camera or VCR to the video the video capture device on your computer. For computers with Fire Wire inputs, you would connect your digital video camera's Fire Wire output to the computer's Fire Wire input. Most other capture devices accept an analog video input, which may be either Composite (usually and RCA phono plug connector) or S-Video (a round 4-pin connector). If this is the case, connect the analog output of your camera to the analog video input of your capture device. If your video capture device has both Composite and S-Video inputs, you may need to choose the input that Isadora is seeing – more on that below. Make sure that your digital camera on to the "camera" setting (i.e., not VCR or Tape) if you want to see live video from the camera.
- To capture live audio, connect your external audio source (mixing console output, cassette player, etc.) the sound input of your computer. Generally speaking, this is a 1/8" mini-phone plug – this is the same size and type of plug seen on headphones that plug into a portable CD player. On computers without audio input, you will need to purchase an external sound input device. Often these connect to the USB port of your computer.
- To start capturing video and audio, choose **Input > Start Video + Sound Input**. When you do, Isadora will attempt to start capturing both video and audio. If for some reason, either video or audio capture cannot be started (e.g., no video camera plugged in to your FireWire port) then Isadora will not capture in that mode.

  If you want to capture only video, or only audio, you can choose the **Input > Start Video Only Capture** or **Input > Start Audio Only Capture**, respectively. The advantage to choosing one of these two options is that you only use the processor power that you need for your application, leaving more power to process video, etc.
- To ensure Isadora can see video, choose the **Input > Show Video Input Preview** to show the Video Preview Window. If everything is working properly, you will the live video signal coming into the computer. If you see a black or blue frame, it is likely that you need to change the capture source, which is explained below. If you see a gray background, Isadora isn't seeing your video device. Close the window when you have verified that Isadora is seeing the input from your video camera.
- To ensure that audio is begin heard by Isadora, choose **Window > Show Status**. Look for the **Sound Input** portion of the status window. If there is sound coming in, you will see the green "level meters" move as the sound level changes. The name to the left indicates the source of the live input.

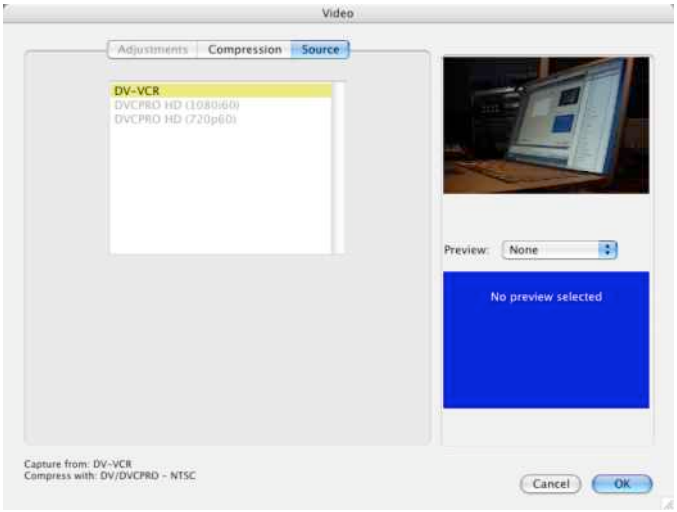


  In the example above, the sound was coming from the computer's built-in microphone.

Setting the Video Capture Source

Once you have successfully enabled video capture, you may need to choose the source of the video input before you see anything. For cameras connected to your Fire Wire port, this usually isn't necessary. But for other analog video capture hardware, or if you have an analog-to-digital video converter connected to your Fire Wire port, you may need to choose between the Composite or S-Video inputs.

- To change the video capture source, choose **Input > Video Input Settings**.
- In the top left of the dialog there is a drop-down menu. Click in it and choose **Source**. The information shown in the dialog will change once you have done so to look something like this:



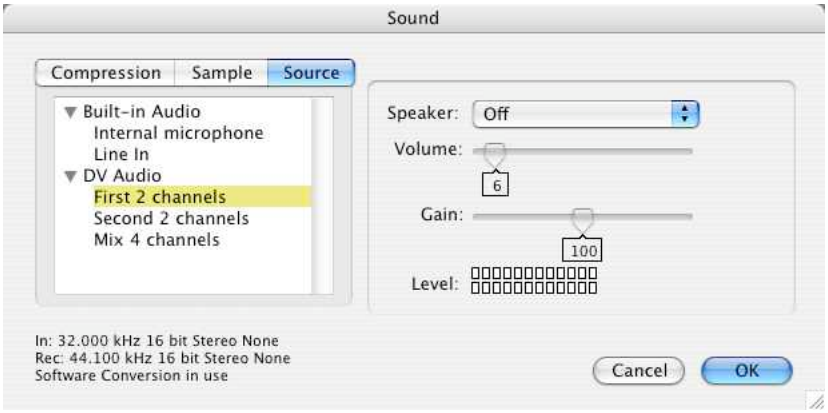
- The main area at the top allows you to select the source for Video Input. In the example above, a FireWire camera has been selected (DV-VCR).
- You may see a drop-down menu labeled **Digitizer**. Make sure that it shows the name of the video capture hardware you want to use. If it doesn't, click in the menu and choose your video hardware.
- On some digitizers, there may be a drop-down menu called **Input**. For analog capture hardware, it will typically contain two items: Composite and S-Video. Choose the one that corresponds to the input to which your camera or other video source is connected.

Once you've done the above, you should be able to see the video image in the right side of the dialog. If not, check that your external video device is powered up, and that the connection is correct. If you still can't get a signal, consult the manual for your video capture hardware.

Setting the Audio Capture Source

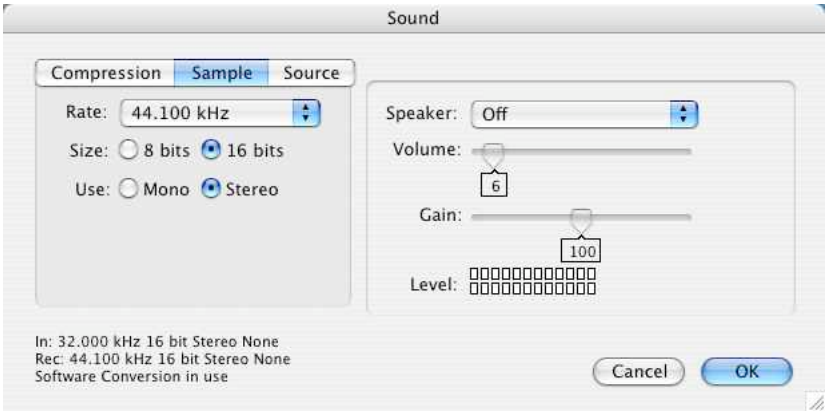
Once you have successfully enabled audio capture, you may need to choose the source of the video input before Isadora will "hear" the sound. You can determine the current audio input by looking at the **Sound** panel in the Status Window.

- To change the video capture source, choose **Input > Sound Input Settings**.
- In the top left of the dialog there is a drop-down menu. Click in it and choose **Source**. The information shown in the dialog will look something like this:



- You will see one or more devices in the area below the Compression/Sample/Source Tab buttons. It may be that the devices inputs are hidden if the disclosure triangle is pointing to the right (as shown below.)

  To reveal the specific inputs, click the disclosure triangle.
- There is another drop-down menu called **Speaker**. If you would like the sound output to be "echoed" through the sound output port, choose "On". You can control the volume of the echoed sound by using the **Volume** slider.
- Once these settings have been configured, and if your audio device is making sound, you should be able to see the "level meters" below the **Gain** slider moving about. This indicates that the sound is getting into your computer.
- If you have a very soft or very loud sound source, you may want to adjust the input amplification by dragging the **Gain** slider on the right hand side of the window. You should set it so that the level meters tend to show a level that hovers around the 3/4 mark. (Note that you cannot adjust the gain of some sound sources, notably the sound input for DV cameras.)
- You may also choose to send the live input to the computer's speakers using the Speaker drop-down menu at the top right. This is discouraged when using microphones as live input devices, as you can get feedback.
- You may also want to adjust the sample size and sample rate by choosing **Sample** from the top-left drop-down menu. After selecting **Sample**, the window will look like this:



- Generally, the best practice here is to set the **Rate** to 44.100 kHz, the **Size** to 16 bits, and the **Use** to Stereo. These settings yield CD-quality audio input. You may the **Use** setting to Mono if you only require monophonic input.

Once you've done the above and clicked OK, you should be able to see the level meters in the **Sound** portion of the Status Window. If not, check that your external video device is powered up, and that the connection is correct. If you still can't get a signal, consult the manual for your audio capture hardware.

Interactively Starting or Stopping Capture & Recording Capture Input

You can interactively turn capture on and off using the Capture Control actor. This actor basically simulates the actions provided under the Capture menu: Start Video + Sound Input, Start Video Only Capture, Start Audio Only Capture, and Stop Video/Audio Input. For video input drivers with more than one input (composite, s-video, etc.) you can also use this actor to the input that will be used to capture. For more info, see Capture Control in the Actors Reference section of this manual.

The Capture To Disk actor allows you to record whatever is being captured to disk, and to then have that newly recorded movie appear in the Media Window. See a full description below under the heading "Capturing Video and Audio To Disk" on Page 124.

Controlling Video Capture Performance

Setting Capture Resolution (v1.1)

You can control the resolution with which Isadora captures the live video. In North America, Digital Video cameras typically provide an image that is 720 pixels across and 480 pixels down. While the quality of such an image is very good, it contains so much data (about 40 megabytes per second) that Isadora can get bogged down attempting to process it all. You can improve up Isadora's performance by scaling the image down to a smaller size. In the **Input > Video Capture Size** submenu, you can choose from the following resolutions:

- **Full Size:** Leaves the captured video at original resolution..

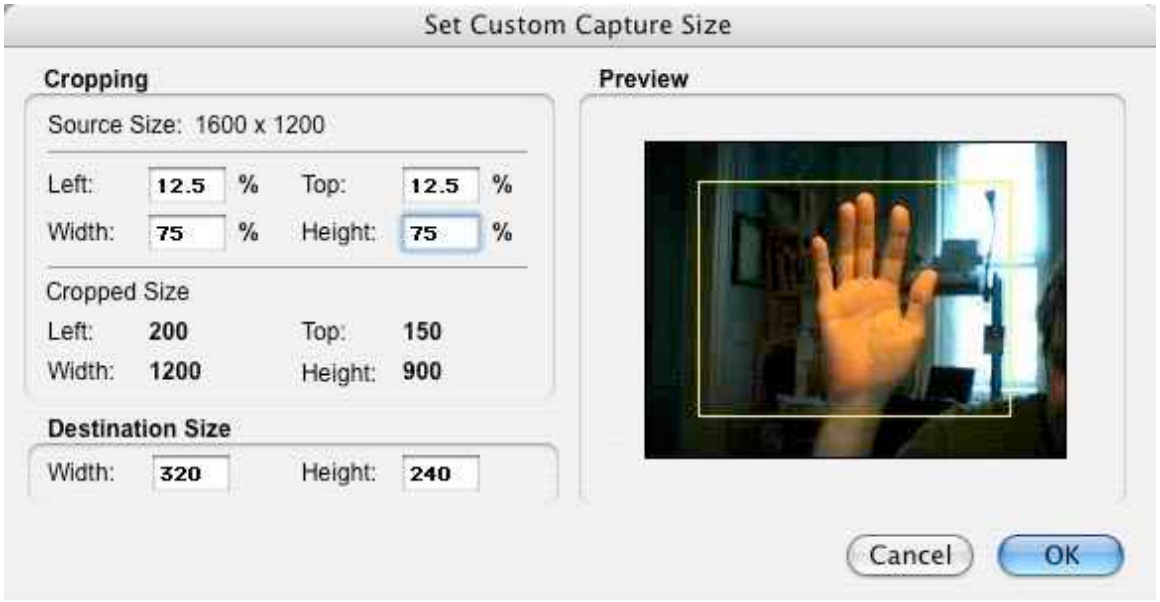
- **Half Size:** Scales the captured video to one-half of its original resolution.
- **Quarter Size:** Scales the captured video to one-quarter of its original resolution.
- **640 x 480 (NTSC Full)** Scales the captured video to a resolution of 640 x 480.
- **320 x 240 (NTSC Half)** Scales the captured video to a resolution of 320 x 140.
- **160 x 120 (NTSC Quarter)** Scales the captured video to a resolution of 160 x 120.
- **768 x 576 (PAL Full)** Scales the captured video to a resolution of 768 x 576.
- **384 x 288 (PAL Half)** Scales the captured video to a resolution of 384 x 288.
- **192 x 144 (PAL Quarter)** Scales the captured video to a resolution of 192 x 144.
- **Custom Size:** Scales and crops the captured video using the settings in the "Set Custom Size" dialog – see below.

Setting a Custom Capture Size (v1.1)

The Set Custom Capture Size dialog allows you to crop and scale the captured video. This is useful if you only want to "see" a portion of the incoming video stream.

To set the Custom Capture Size, do the following:

1) Start Video Capture using the **Input > Start Video + Sound Input** or **Input > Start Video Only Capture**. This isn't absolutely necessary: you can set the custom capture size without live video coming into the computer. But if video capture is active, the dialog will provide a preview that will make help you visualize the portion of the image that is being captured.
2) Choose **Input > Set Custom Size…**
3) The following dialog will appear



4) The cropping of the image is set using the Left, Top, Width and Height boxes under the **Cropping** heading. These are specified as a percentage of the incoming video's native resolution, from 0 to 100%. As you change the values in these boxes, the size of the cropped image in pixels will be shown in the area just below. In addition, a yellow rectangle will appear over the live video preview to give you a sense of the cropped video image.

5) The final resolution of the video stream, as it will appear at the Video In Watcher actor's output, is set by the Width and Height values seen under the Destination Size heading. These are specified in pixels. If you don't want to scale the image, set these to match the Width and Height shown under "Cropped Size."

6) Once you are satisfied with the settings, click OK to save them.

To capture video with the custom cropping and size you've specified, choose **Input > Video Capture Size > Custom Size**.

Controlling Capture Quality

You can also control the quality of the capture. It is a bit hard to describe what effect this will have on the image, as each capture "codec" interprets the capture quality setting in a different way. Nevertheless, you can depend on the fact that capturing using at a lower quality will speed up the rate at which frames will be captured and processed.

- To change the quality with which Isadora is capturing video, choose a setting in the **Input > Video Capture Quality** menu. The possible choices are **Maximum Quality**, **High Quality**, **Normal Quality**, **Low Quality**, **and Minimum Quality**.

Forcing a 4:3 Aspect Ratio

There is also a setting in the **Capture** menu called **Force 4:3 Aspect Ratio**. When this option is chosen, the captured video stream is scaled so that its aspect ratio (ratio of width to height) is 4 to 3.

Some capture cards capture at this ratio (e.g., 640x480 or 320x240) normally, and so turning on this setting will have no effect. However, forcing the 4:3 ratio is useful when capturing digital video (DV) streams via Fire Wire. For instance, a DV-NTSC stream has a resolution of 720x480 – an aspect ratio of 1.5 to 1.

Using this setting improves performance if, in your Isadora file, you are combining captured live video that does not have a 4:3 aspect ratio with movies that do. In addition, it makes the image a bit smaller, leaving fewer pixels to process.

Capturing Video and Audio To Disk

The Capture To Disk actor allows you to start or stop recording the current capture input to your computer's hard drive. After capture is completed the newly recorded movie will appear in the Media Window so that you can play it using any of the Movie Player actors. Note that if video and/or audio capturing must be active for

this actor to have any effect. (You start live capture using the menu commands under the Capture menu or with the Capture Control actor.)

This function is useful in interactive setups where you want to record something that is happening live, and subsequently manipulate that recorded imagery in Isadora.

Starting Capture To Disk

To have the Capture To Disk actor start recording, you would set the function property to start and then send a trigger into the trigger input. The movie property determines where the recorded movie will appear in the Media Window when recording is stopped. If this property is set to add, then the newly recorded movie will be added after the last movie currently in the Media Window. If this property is set to a number, then the movie currently at that location in the Media Window will be replaced by the new movie.

In terms of organizing the Media Window when using the Capture To Disk actor, the best practice is to add some movies into the window and clear them (using **Edit > Clear**) so that they appear as <Unassigned>. Then you can use these locations in the Media Window to hold your newly recorded movies.

It is important to understand that if you specify a number in the movie property, there must be a movie at that location in the Media Window. Otherwise, the movie will not appear in the Media Window.

Furthermore, if you have a Movie Player in the same scene with the Capture To Disk actor, then its visible property must be off while you are recording. Otherwise, the movie is "busy" and cannot be replaced. If you want a Movie Player to play a newly recorded movie in the same scene in which it was recorded by the Record To Disk actor, take the following steps:

1) Make sure that the visible property of the Movie Player is off while you are recording.
2) Use the Record To Disk actor to start recording, specifying the place where the new movie will appear in the Media Window.
3) Use another Record To Disk actor to stop recording.
4) Set the movie property of the Movie Player to the location of the newly recorded movie in the Media Window.
5) Set the visible property of the Movie Player to on.

Stopping Capture To Disk

To have the Capture To Disk actor stop recording, you would set the function property to stop and then send a trigger into the trigger input. The movie property has no effect when the function property is set to stop – the movie will be stored in the location specified by the Capture To Disk actor that initiated the recording process, regardless of its setting here.

Once recording is stopped, the movie will appear in the Media Window at the location specified earlier. At this point, it can be played like any other movie that has been imported into the Media Window.

Specifying the Location on Disk for Captured Media

You can specify a folder into which movies recorded using the Capture To Disk will be placed. To do so, choose **Input > Set Captured Media Folder**. When you do, a file dialog will appear. Use this dialog to select the folder to which you would like your movies to be recorded, and then click the "Choose" button to confirm your choice.

Deleting Captured Media

If you have used the Capture To Disk actor to record one or more movies, and you then attempt to close the current document or quit Isadora, the following message box will appear:

Do you want to permanently delete from the hard disk all of the temporary media recorded during this session? (This operation is not undoable.)
While using this Isadora document, you recorded and stored temporary media into the Media Window.
Choose "Yes" to delete the media. Choose "No" to keep the newly recorded media in the Media Window. Choose "Cancel" if you do not want to close this file.
No
Cancel
Yes

If you choose “Yes” to delete the media, then all of the movies you recorded will be deleted and their references in the Media Window set to <Unassigned>. If you choose “No”, then the movies will not be deleted and their references in the Media Window are unchanged. This latter option means that when you next load the Isadora document, you will be able to play the movies that you captured previously. You can choose “Cancel” if you do not want to close or quit.

Compositing with the Projector using Hardware Accelerated Rendering (v1.1)

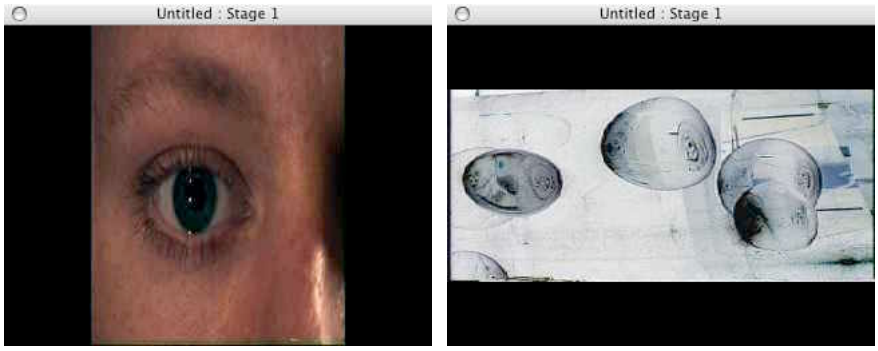
Isadora v1.1 allows you to use Hardware Accelerated Rendering to render images to the stage. On most modern computers, this results in significant speed increases and higher quality output. Enabling this Hardware Accelerated Rendering (HAR) in the Preferences also enables important features in the Projector actor. This section will help you understand how best to take advantage of these features.

Layering & Blending

In previous versions of Isadora, you were only able use two or more projectors in the same scene if the images did not overlap. Hardware Accelerated Rendering overcomes this limitation, and allows much more flexible compositing of images on the same stage.

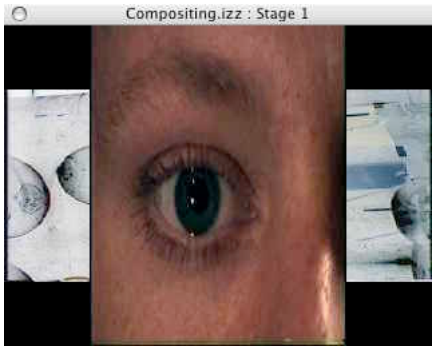
To help you understand these principals, you can follow along in the file called “Compositing.izz” which is included with the Isadora Examples folder included with the program.

In the first scene, there are two Movie Players, each connected to their own projector. Individually, the movies are scaled so that the look like this:



Note that the Eye image has been scaled horizontally and moved to the righ, and the Bubbles image has been scaled vertically and moved down. This has been accomplished using the top, left, height, and width inputs, which have been available in the Projector actor since the first version of Isadora.

But, when both Projector actors are turned on, the result looks like this:



This kind of layering was not possible in the first version of the program.

Now, try the following experiments to see other features that are available in v1.1.

- Look at the layer input of both projectors: the top one (the Bubbles) is set to 0, while the lower one (the Eye) is set to 1. Try changing the layer input of the top Projector to 2. You will see that the Bubbles are now rendered on top of the Eye.
- Click on the dot to the left of the intensity input on of the top projector. Drag the slider down to the bottom. As you do, you'll notice that the top image eventually turns black. When the blend mode is set to opaque and you lower the intensity, the image eventually becomes a solid black square.
- Switch the blend mode on the top projector to transparent (click on the box to the left of the word blend and type 'transparent' and hit return). Now try the same experiment from the previous paragraph. Now, instead of fading to black, the intensity controls the transparency of the image. The lower the intensity, the more "see through" the top image becomes.

  IMPORTANT: When attempting to render a transparent image, it is essential that it is rendered last, otherwise the transparent image feature may not work. (Generally this will result in on of the lower images appearing opaque and "on top of" the transparent image.) To specify the order in which Projectors render their images, use the layer input. Higher layer numbers are drawn last, so you will want to use a higher layer number for Projectors whose blend input is set to transparent.
- Now, switch the blend mode on the top projector to additive (click on the box to the left of the word blend and type 'add' and hit return). Again, use the slider to adjust the intensity. The intensity fades the image in and out, but now the front most image is "added" to the image below – the Eye never totally disappears because the two images are added together.
- Finally, restore the intensity of the top projector to 100, and then its layer input to 0, so that the Bubbles are "under" the Eye again. Now, even though the blend mode of the Bubbles remains set to additive, the Eye isn't being added to the Bubbles. Why? Because the blend mode of the Eye is still opaque. Since it's now the one in front, it is "written over" the Bubbles, not added to it.

Just working with these the layer, blend and intensity parameters offers incredible flexibility with how you composite images. In previous versions of Isadora you

needed to use a Video Fader to cross fade from one image to another. In version 1.1 it is possible to use two projectors and fade one in while the other fades out.

- Click on the Scene called Crossfade to see an example of this. Press the space bar to cross fade between the two videos using an Envelope Generator and two Projectors actors. Note that the mode of both actors is set to additive. This patch won't work as expected if they are set to other modes –!try changing the blend input of the two projectors to see the results.

Distorting the Image

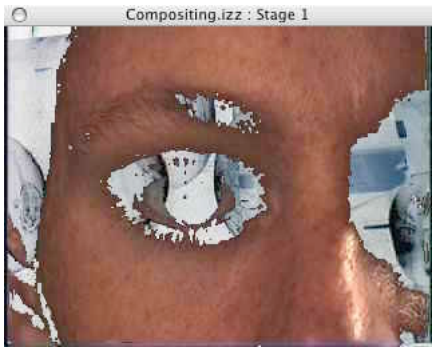
Click on the Scene called "Layering" and try the following:

- Click on the dot to the left of the spin, aspect ratio, and perspective inputs and drag the slider to observe the effect of these parameters on the image.

By rotating the image, changing its aspect ratio, and introducing perspective shift, you can position an image quite precisely onto a specific object in the field of view of your video projector. This can be an effective way to use one video projector to project onto multiple surfaces simultaneously.

Alpha Channels

Click on the Scene called "Alpha Mask." The image shown on the stage looks like this:

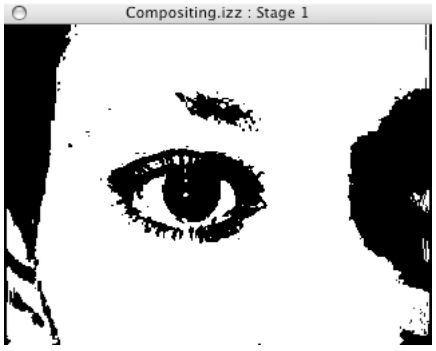


If you've used Isadora's Luminance Key actor before this image might look familiar – the darker portions of the foreground image (the Eye) are transparent, such that you can see the Bubble image below. But instead of using the Luminance Key actor, this actor instead uses the built in Alpha Masking features available when using HAR.

Alpha Masks are used to blend two images. An alpha mask is usually a gray scale image; white means that the foreground image is opaque, black means it is fully transparent, and gray means that it is partially transparent. When using HAR, the projector will respect any alpha channel information that is with your video stream. Here's how it works.

- Of special importance in the "Alpha Mask" scene is the bit between the lower Movie Player and its Projector:

First is the Threshold actor: this creates a black and white image based on the brightness of the video stream coming from the lower projector. If you were to connect the output of Threshold directly to the projector, you would see something like this:



Instead, the output of Threshold goes to the mask input of the Add Alpha Channel actor. Add Alpha Channel doesn't change the image arriving at its video input; instead, it adds the alpha information into that video stream so that it will travel along with it through the rest of the Scene.

Because the Add Alpha Channel actor has added the alpha channel information to the video stream, and because the projector's blend input is set to transparent, the alpha channel information is used when the Eye is rendered on top of the Bubbles. Where the image from the Threshold actor is white, you see the Eye; where it is black, you see the Bubbles.

YUV Video Processing (v1.1)

Isadora v1.1 allows you to process video in the YUV format instead of the RGB format used by most video processing software. The advantages of YUV are 1) each YUV pixel occupies half of the memory needed for an RGB pixel, and 2) because many movie and picture files use YUV as their native format (e.g., Photo JPEG and DV.) Because YUV occupies half the memory as RGB, and because incoming video being does not need to be converted to RGB before Isadora can process it, using YUV mode can result in significant speed improvements.

IMPORTANT: The one thing you want to avoid when using YUV processing is horizontal resolutions that are odd, i.e., not divisable by two. Because each pair of pixels shares color information, using odd widths can cause various algorithms to prouduce unexpected results. Isadora helps to prevent this by forcing the horizontal resolution of Movies and Pictures to be an even number when using YUV mode.

Most actors in Isadora are optimized for to process YUV video. (Actors that prefer RGB video are indicated by the fact that their video input says rgb in instead of video in.) For these actors, the video stream is automatically converted from YUV to RGB before processing. Note too that ***none*** of the plugins created under the FreeFrame Standard process YUV natively (For more information about FreeFrame plugins, see page 103.). So, YUV video input to FreeFrame plugins will be automatically converted from YUV to RGB.

YUV is not without its disadvantages however. Unlike RGB, where each pixel specifies color very precisely, every two YUV pixels *share* the same color information. That means that effects that tend to single pixels of widely varying color (e.g., Shimmer) will not look as pristine in YUV mode.

You can use the **YUV to RGB** and **RGB to YUV** actors to convert a video stream from one format to another. Note however that the conversion from RGB to YUV and vice-versa is a "lossy" algorithm –!repeated conversions may be lead to a loss in image quality.

Working with YUV

To enable the YUV Processing:

- Choose **File > Enable YUV Mode**. The current document will then use YUV mode when playing back movies and when capturing live video. This setting is saved with the document.

To disable the YUV Processing:

- Choose **File > Disable YUV Mode**.

To determine if a video stream is RGB or YUV:

- Point the mouse cursor at a link between a video output and a video input. A small window will appear that shows a thumbnail of the video, along with its mode (RGB or YUV) and resolution.

To determine if an actor can process YUV video without conversion to RGB:

- Look at the video input: if it is called rgb in instead of video in then the actor cannot process YUV video natively. If you send YUV video into such an actor, it will automatically be converted to RGB. Note too that the output will be RGB –!you may want to use the RGB to YUV actor to explicitly convert the output video stream to YUV if you will be passing the output on to actors that can process native YUV.

Recording the Stage Output

Isadora allows you to record the output of one of the Stages to a QuickTime movie. This is useful if you would like to use manipulate Isadora's video output in another program, or just if you'd like to make a record of the video you are creating.

Rendering Complicated/High-Resolution Scenes

Isadora's output will slow down when rendering Scenes that have high-resolution movies (i.e., 720x480 DV movies, etc.) or when it is processing video through many actors. To achieve full frame rates when recording in these situations, use the Render Speed setting in the Record Settings dialog.

Setting the Render Speed to a value below 100% slows down Isadora's internal clock. This means that all media, as well as actors that reference time (e.g., the Envelope Generator, Pulse Generator, etc.), run at a proportionally slower rate. It does not, however, slow down the processing of video. Using a low Render Speed ensures that very complicated, high-resolution video Scenes can be fully rendered before each frame needs to be stored in the output movie. It also means that Isadora will not run in real-time.

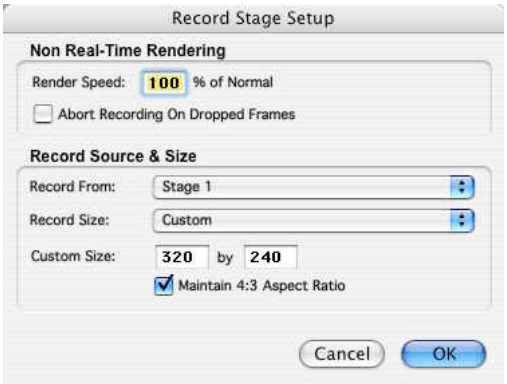
One way of determining the correct Render Speed setting is to watch the Status window as you record Isadora's output. The Cycles value should be greater than the frame rate of the movie to which you are recording. If it isn't, choose a lower rendering speed and try again.

You can also check the **Abort Recording On Dropped Frames** checkbox in the Record Settings dialog (see below.) If you do, recording will be aborted if Isadora can't keep up with the frame rate specified in the Compression Settings dialog. If Isadora aborts the recording process, set the Render Speed to a lower value and try again.

Adjusting the Recording Settings

To change the Recording Settings:

- Choose **Record > Record Settings…** to show the Record Settings dialog. Initially, it will look like this:



- Set the rendering speed by entering a value between 1 and 100 in the Render Speed edit text box. Lowering this value slows down Isadora's internal clock, giving it more time to finish all video processing before it has to store a frame to the output movie. This means that Isadora won't run in real time, but it allows you to generate output at the frame rate specified in the Compression Settings dialog without dropping frames. (See Rendering Complicated/High-Resolution Scenes above for more details on this feature.)
- If you want Isadora to abort the recording process if it cannot achieve the frame rate specified in the Compression Settings dialog, check the **Abort Recording On Dropped Frames** checkbox. Isadora will automatically stop recording and show an alert box if this box is checked and it drops a frame during recording.
- Select the Stage whose output you would like to record using the Record From pop-up menu.
- Select the size of the movie by selecting an option from the Record Size pop-up menu.

  There are four options: **Full Stage Size**, **Half Stage Siz**e, **Quarter Stage Size** and **Custom**. If you choose one of the first three, the output size of the movie will be based on the size of the stage. If you choose Custom, two text edit boxes will appear allowing you to set the horizontal and vertical size of the movie output, respectively.

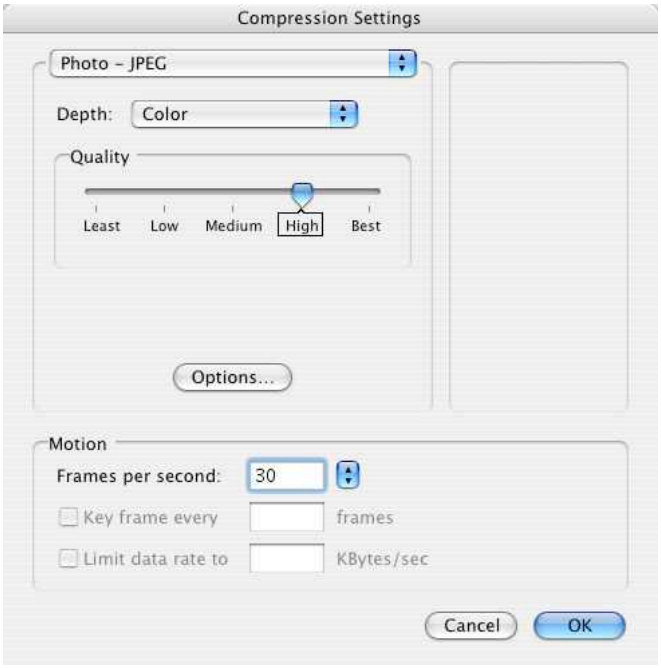
  If you check the **Maintain 4:3 Aspect Ratio** checkbox, typing a number in the horizontal or vertical custom size will automatically update the other field so that the ratio of horizontal to vertical is 4 to 3.

  Note that all of the settings you make here are remembered in the Preferences. They will be as you left them the next time you run Isadora.

Adjusting the Compression Settings

To set the compression settings for the movie:

- Choose **Record > Compressing Settings…** to show a standard QuickTime compression setup dialog. Initially, it will look like this:



- Select the Compressor used to compress the video by selecting and option from the pop-up menu under the Compressor heading.

  The compressor you choose has a profound influence on the quality of the output image and the speed with which Isadora can compress the frames. For instance, Sorensen and Cinepak generate very small movies, but are extremely slow, leading to poor frame rates. We have found that using Photo JPEGA, Medium Quality, at 15 FPS provides workable results. You can also try the DV-NTSC or DV-PAL compressors – they look good and are fairly fast, though the size of the resulting movie can be quite large.
- Set the quality of the output by adjusting the slider under the Quality heading. The thing to know here is that the higher the quality, the larger the resulting movie will be. You may need to experiment with various settings to find the best compromise between quality and size of the resulting movie.
- Set the Frames Per Second. Isadora will do its best to output the movie at the rate you specify here. However, if a Scene is quite complicated and Isadora can't generate video frames at the rate you request, the true rate might be less than you specify. Remember, if you want to ensure full frame rates in the output movie, lower the Render Speed setting in the Record Settings dialog. (See Rendering Complicated/High-Resolution Scenes above for more details on this feature.)
- Click OK to confirm the settings you have made.
- The settings listed above are the most important. There are various other options depending upon which compressor you choose – check Apple's QuickTime documentation for more information about the various compressors and their settings.

Recording Isadora!s Output

To record Isadora!s output to a QuickTime movie:

- Make sure you have selected the Stage to be recorded and size of the output using the R**ecording Settings** dialog (see above.)
- Choose **Record > Start Recording**.

  If the compression settings have not yet been set (see above) the compression settings dialog will be shown. If the compression settings have already been set, then the previous settings will be used to compress the movie.
- Now, a standard file dialog will appear. Use it to specify the name of the new movie, and where you would like it saved. Click OK to confirm the dialog.
- Recording will begin immediately.

To stop recording the output:

- Choose **Record > Stop Recording**.
- The recorded output will appear with the name, and in the location you specified in the standard file dialog box that was shown when you started recording the output.

Mirroring Video to an External Device (v1.1)

Isadora now allows you to mirror one of its Stages to a FireWire camera or to other devices such as video output cards.

Start by installing the video card or connecting your FireWire device. Then, take the following steps:

- Choose the stage to be mirrored to the external video out. Do this by choosing **Isadora > Preferences** (MacOS) or **Edit > Preferences** (Windows) and clicking on the **Video** tab. There you can set the stage to be mirrored to the external output. The default setting is Stage 1.
- Choose the device to which the Stage will be mirrored by selecting it from the **External Video Output** submenu found in the **Output** menu. The default device will be FireWire, but if you have a hardware video output card, you will be able to choose it if QuickTime supports it as an output device.
- Once you've selected the video output device, you will need to choose the output mode from the **External Video Out Mode** submenu, also found in the **Output** menu. For FireWire cameras, you will choose the proper output mode for your camera: NTSC 29.97, PAL 25.0, etc. If you choose the wrong mode for your device (i.e., PAL for an NTSC camera) the output won't work. (Note: The DV-PRO options don't seem to work with a standard FireWire camera – you will want to choose "Apple FireWire NTSC" or "Apple FireWire PAL".
- Once you've made these choices, show the stage (**Windows > Show Stages**) and then activate the output by choosing **Output > Start External Video Out**. You should now see the output of the stage appearing on your camera.

- You can stop mirroring to the external device by choosing **Output > Stop External Video Out.**

Note that the External Video Out feature only *mirrors* the output of the stage. No images will be sent to the camera if the stage is not visible.

MIDI Input and Output

Isadora has a full complement of actors that allow for interactive control via MIDI. But before you use the actors, you must configure Isadora for MIDI Input and Output.

Hardware Interface & Drivers

Before you begin, you must have a hardware MIDI interface that allows you to connect MIDI devices to your computer. Before using this device with Isadora, you must install the hardware drivers for the interface. To do this, please follow the installation instructions in the interface's manual. Note: Isadora should not be running when you install the drivers, otherwise it may not see the interface.

After you've installed any required drivers, you should connect the MIDI interface to your computer. These interfaces are most often connected to a USB port with a standard USB cable. Once you've done this, you're ready to start up Isadora.

Midi Setup

Ensure that your hardware MIDI interface is connected to your computer. Then start Isadora and choose **Windows > Midi Setup**. A dialog will appear that looks like this:

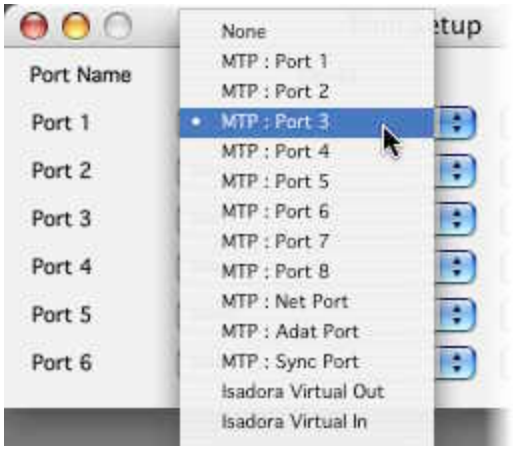
This window determines how the physical inputs on your MIDI interface will be associated with Isadora's MIDI input and output ports.

For sake of clarity, we will refer in this document to the MIDI ports on your MIDI interface as *Physical* ports to differentiate them from Isadora's MIDI Input and Output Ports.

Associating a Physical Input Port to an Isadora MIDI Input Port

If you want to receive MIDI input from a particular port on your MIDI interface, do the following:

1) Choose an unused Isadora MIDI Input port to receive the MIDI data – from Port 1 through Port 6.
2) Click on the popup menu to the right of that port name, under the heading **Inputs**.
3) In the popup menu, you will see a list of physical input ports available on your MIDI interface. Choose the physical input to which your MIDI device is connected and release the mouse.



4) Choose **Windows > Show Status** to show the Status Window. Have your MIDI device send data to the input port (e.g., if you have a MIDI keyboard, press keys on the keyboard.) If everything is working correctly, you should see one of the indicators associated with the port you chose in Step 1 blink as the MIDI data comes in.

If you are not receiving any MIDI data, check the following:

1) Ensure that you have connected the MIDI Out of your device to the MIDI In of your physical interface, and that the MIDI cable is in working order.
2) If your MIDI interface has an indicator that shows when MIDI data is being received, make sure this blinks when your device is sending MIDI data.
3) Check that the physical input you chose in the MIDI Setup dialog matches the input to which the MIDI cable is connected.

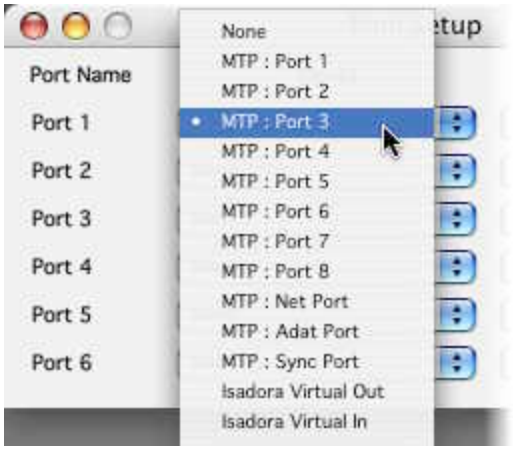
Associating an Isadora MIDI Output Port to a Physical Output Port

If you want to send MIDI output to a particular port on your MIDI interface, do the following:

1) Choose an unused Isadora MIDI Output port on which the MIDI data will be sent from one of the MIDI output actors – from Port 1 through Port 6.

2) Click on the popup menu to the right of that port name, under the heading **Outputs**.

3) In the popup menu, you will see a list of physical output ports available on your MIDI interface. Choose the physical output to which your MIDI device is connected and release the mouse.



4) If you haven't already, set up a MIDI output actor, e.g., the Send Note actor. Set its port input to match the port you chose in Step 1, e.g., for Port 2 you would set the port input to '2'. Then trigger the actor – you should hear/see your device respond. (If your device has a MIDI Status indicator – see if it blinks when you trigger the actor.)

If your device is not receiving any MIDI data, check the following:

1) Ensure that you have connected the MIDI Out of your interface to the MIDI In of your device (e.g., Keyboard, Synth, etc.), and that the MIDI cable is in working order.

2) If your MIDI interface has an indicator that shows when MIDI data is being sent, make sure this blinks when you trigger a MIDI output actor set to transmit on the correct port.

3) Check that the physical output you chose in the MIDI Setup dialog matches the output to which the MIDI cable is connected.

Isadora Virtual MIDI Inputs & Outputs (v1.1, MacOS)

Isadora on MacOS has both a virtual MIDI input and virtual MIDI output. These allow you to connect Isadora to another piece of MIDI software running on your computer. To use the virtual inputs or outputs, do the following:

Sending MIDI to another application on Isadora!s Virtual MIDI Output

1) Start Isadora before you start up the other piece of software.

2) Start the other application.

3) Choose Windows > MIDI Setup

4) Select an Isadora MIDI Output port on which to transmit to the other application. In the popup menu under the **Outputs** heading, choose “Isadora Virtual Out”.

5) Go to the MIDI setup for the other application. Chose “Isadora Virtual Out” as the input source.

Now when you send MIDI messages on the selected Isadora MIDI Output, they will be transmitted via Isadora’s Virtual MIDI Output and received by the other application.

Receiving MIDI from another application on Isadora!s Virtual MIDI Input

7) Start Isadora before you start up the other piece of software.

8) Start the other application.

9) Choose Windows > MIDI Setup

10) Select an Isadora MIDI Input port on which to receive MIDI from the other application. In the popup menu under the **Inputs** heading, choose “Isadora Virtual In”.

11) Go to the MIDI setup for the other application. Chose “Isadora Virtual In” as an output for the program.

Now when you send MIDI messages from the other application, they will be received via Isadora’s Virtual Input on the selected Isadora MIDI Input Port.

Open Sound Control (OSC) (v1.1)

Isadora now has support for Open Sound Control (OSC). This is a standard protocol that allows two pieces of software to communicate with each other, either on the same computer or on computers connected via a local area network.

How Open Sound Control Communicates

While Open Sound Control is not limited to any physical communications standard, the most common way to send messages is via UDP (User Datagram Protocol), a method used to send data over the Internet.

To send data to an application on another computer, you must know its TCP/IP address. In addition, an OSC application “listens” for messages on a specific UDP *port number* ranging from 1 to 65535. You must know both of these numbers before you can send OSC packets to another application on a remote computer. You must also know the OSC address to which the data will be sent – this information can usually be found in the documentation for the program.

If you are transmitting data between two programs running on the same computer, you can use the special address **localhost** (which translates to an IP address of 127.0.0.1) to indicate that the data will be transmitted locally. This should work even if you computer is not connected to a router or switch via a built-in Ethernet interface or via a wireless interface.

If you intend to send Open Sound Control packets between two computers, the first step is to ensure that both computers have been assigned a valid TCP/IP address.

On MacOS X, you can find the TCP/IP address of your computer by opening the System Preferences and clicking on Network. You will then see the active TCP/IP interfaces on your computer (e.g., built-in Ethernet, AirPort, etc.) and their IP Addresses. Any of these addresses may be used to receive data.

Receiving Open Sound Control Packets

Generally speaking, when sending messages from another computer, you will specify three pieces of information to define where the information will go: the target machine's IP address (i.e., an internet address like 123.234.555.121), a UDP port number between 1 and 65535, and the OSC address (i.e., /isadora/1). You also usually need able to specify whether or not to send "type tag" information with the OSC packet – **this must be turned on for Isadora to receive the packets and interpret them correctly**.

Isadora has 32 Open Sound Control addresses to which data may be sent. They range from **/isadora/1** through **/isadora/32**. Isadora expects receive either floating point or integer numbers on these inputs, and the **type flag must be sent** with the data. The OSC Listener actor will receive values sent to these channels based on the channel setting, e.g., a value sent to /isadora/5 will be sent to the OSC Listener with its channel set to 5. (For more information on the OSC Listener, see Page 248).

In addition, there are four "multi" inputs – **/isadora-multi/1** through **/isadora-multi/4**. On these four ports, you can send a message with multiple floats and/or integers. Using the type tag information (required) the individual values will be sent sequentially to the 32 OSC inputs. For example, if a message consisting of two integers and two floats

5 525 1.234 5.869 (type tags = iiff)

is sent to /isadora-multi/1, the OSC Listener actors with their channels set to 1, 2, 3 and 4 will receive 5, 525, 1.234, and 5.869 respectively.

The TCP/IP "Port Number" used to receive OSC messages can be set in the Preferences. (See Page 112 for more information.) When receiving values from another application, the port number specified when transmitting the data must match the one set in Isadora's Preferences.

Transmitting Open Sound Control Packets

The OSC Transmit actor will transmit OSC packets consisting of a single floating-point value to another computer. You simply need to specify the IP address and port

of the target computer (or **localhost** if transmitting to an application running on the same computer as Isadora), as well as the Open Sound Control address that will receive the packet.

See the documentation for the OSC Transmit actor on Page 249 for more information.

Transmitting/Receiving OSC Without a Router

IMPORTANT: DO TRY THE PROCEDURE BELOW UNLESS YOU UNDERSTAND HOW TO RESTORE YOUR NETWORK SETTINGS! If you don't restore the settings when you connect your computer to the Internet again, your Internet connectivity won't work.

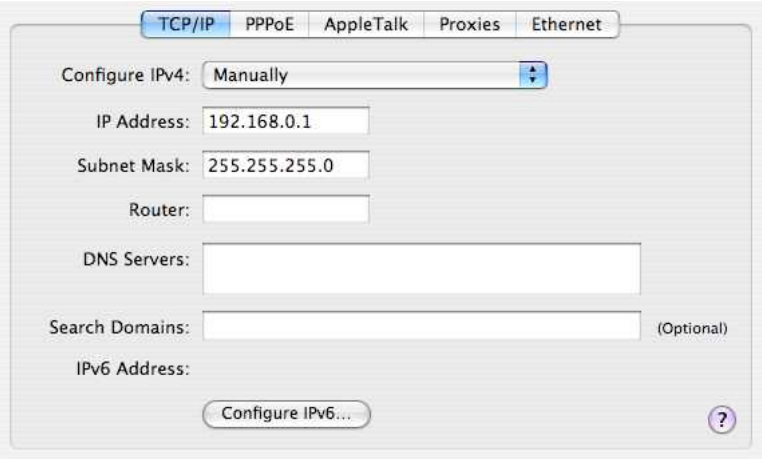
It may occur that you want to communicate between two computers that are connected directly to each other, i.e., an Ethernet cable is running between them. In this case it is often necessary to set both computers to a unique fixed IP address.

We often use the address 192.168.0.xx, where xx is 1 on one computer and 2 on the other. (Each IP address on a network must be unique.) We then set the subnet mask to 255.255.255.0.

You can specify a fixed IP address on both MacOS and Windows computers.

Setting a Fixed IP Address on Mac OS X:

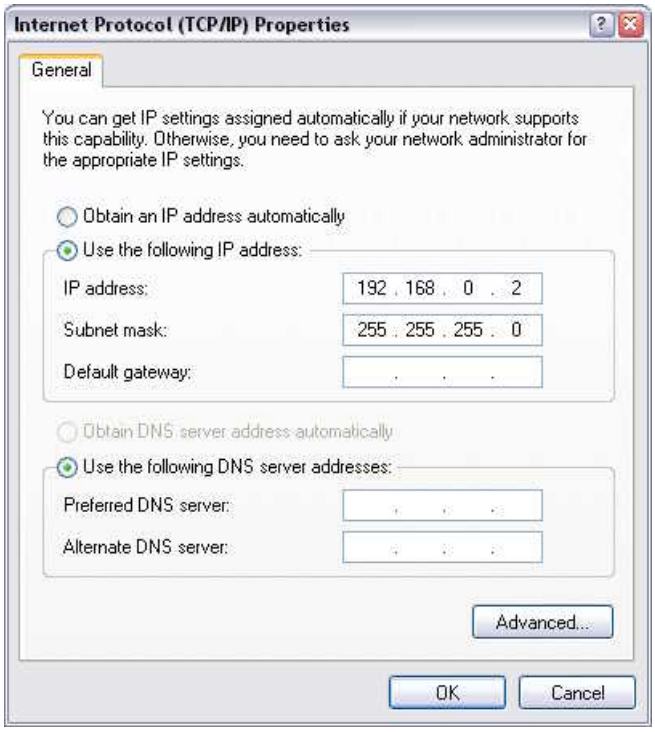
- Open the System Preferences and click "Network".
- Start by creating a new configuration. From the "Location" popup menu choose "New Location…"
- In the dialog box that appears, set the name of the configuration – i.e., OSC Fixed Address and click OK.
- From the "Show" menu choose "Network Port Configurations"
- Uncheck everything except "Built-in Ethernet"
- Now, from the "Show" menu choose "Built-in Ethernet"
- Click on the TCP/IP tab



- Next to the caption “Configure IPv4”, select Manually.
- Set the IP Address field 192.168.0.1
- Set the Subnet Mask field to 255.255.255.0
- Click the Apply button.

Setting a Fixed IP Address on Windows XP:

- From the Start menu, choose “Control Panel”
- If you are not in Category View, click “Switch to Category View” at the top left of the window.
- Click “Network and Internet Connections”.
- Click “Network Connections”
- In the window that appears, you should a document called “Local Area Connection” or something similar – this would be the connection used with your Ethernet cable to access the Internet. Double click this icon.
- Click the “Properties” button. A window labeled “Local Area Connection Properties” should appear.
- Click on the TCP/IP tab
- In the list in the middle of the window, is a list under the heading “This connection uses the following items.” Find an item that has TCP/IP in its name (you may have to scroll down) and double click this item. A window labeled “Internet Prototcol (TCP/IP) Properties” should appear.


Internet Protocol (TCP/IP) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
192 . 168 . 0 . 2
Subnet mask:
255 . 255 . 255 . 0
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

- Click the button that says “Use the following IP address:”
- Set the IP address 166.84.250.2

- Set the subnet mask to 255.255.255.0
- Click the OK to save your changes and dismiss this window.
- Click OK to save the changes to “Local Area Connection”
- Click “Close” to close the first window.

Serial Output (v1.1)

Isadora can transmit data via standard serial hardware installed on your computer using the Send Serial Data actor. Before you use this actor, you must configure Isadora for Serial Output.

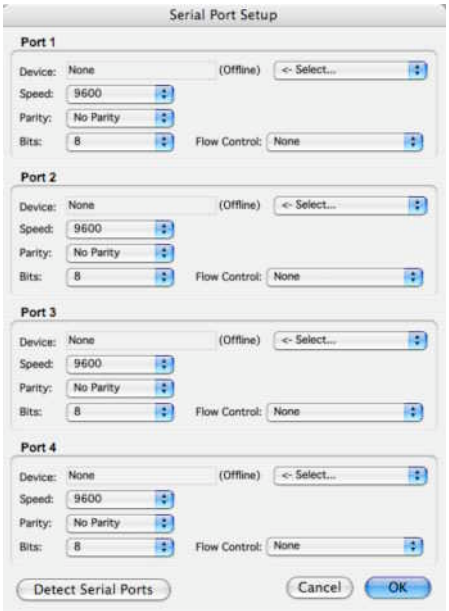
Hardware Interface & Drivers

Before you begin, you must have a hardware serial interface that allows you to connect serial devices to your computer. Before using the interface with Isadora, you must install its drivers. To do this, please follow the installation instructions in the interface’s manual. Note: Isadora should not be running when you install the drivers, otherwise the interface may not be recognized.

After you’ve installed any required drivers, you should connect the install the serial device or connect it to your computer as appropriate.

Serial Port Setup

Ensure that your serial input/output interface is connected to/installed on your computer. Then start Isadora and choose **Output > Serial Port Setup**. A dialog will appear that looks like this:



This window determines communications settings of Isadora's two serial output ports, and whether or not the port is enabled.

Preparing a Port for Serial Communications:

1) Select the desired output device from the popup menu at the right. After you do so, the name of the device will appear next to the caption **Device** on the left side. It will also indicate if the device is currently online.
2) Set the speed, parity, and number of bits to transmit.
3) If necessary, set the "Flow Control" popup to Hardware to enable hardware handshaking, or Xon/Xoff to enable software handshaking.
4) Repeat if necessary for Ports 2, 3 or 4.
5) Click OK to confirm your settings.

Enabling for Serial Communications:

To enable serial communications, choose **Output > Enable Serial Ports**. Isadora will report an error if there are any problems initializing the serial ports. Otherwise you can assume that serial communications have been enabled. Note that this setting is saved with the Isadora document. If you save the document with the serial ports enabled, Isadora will attempt to open those ports the next time the document is opened.

Sending Serial Data:

See the documentation for the Send Serial Data actor on Page 264 for information on how to send data to the serial port.

Using External Multi-Channel Sound Output

Isadora allows you to output sound to a variety of external, multi-channel sound output devices. This means that you can route the sound output of a Movie Player or Sound Player object to separate outputs, which can be very useful in performance situations where you want the various sounds to appear on separate channels of a mixing console.

To use this feature, you must have a multi-channel audio device connected to your computer. On MacOS 9 and Windows, Isadora uses ASIO (Audio Streaming Input Output) drivers to communicate with the external hardware. On MacOS X, it uses CoreAudio.

Installing Drivers

Before attempting to use multi-channel output in Isadora, you should ensure that the drivers for your device are installed and working properly. Here is what you should do for the various operating systems:

• On **MacOS 9** install the ASIO driver for your device in an appropriate ASIO Drivers folder. Generally, this can be found in the Extensions folder. But you can also place a folder called “ASIO Drivers” in the same folder as the Isadora application, or install a folder “Isadora ASIO Plugins” in the extensions folder. Note that any of these can be an alias to another folder.

To summarize, Isadora looks for ASIO driver folders in this order:

1. A folder or alias called “ASIO Drivers” in the same folder as the Isadora application
2. A folder or alias called “Isadora ASIO Drivers” in the Extensions folder
3. A folder or alias “ASIO Drivers” in the Extensions folder.

Isadora will load the ASIO drivers from the first folder in this list that it finds.

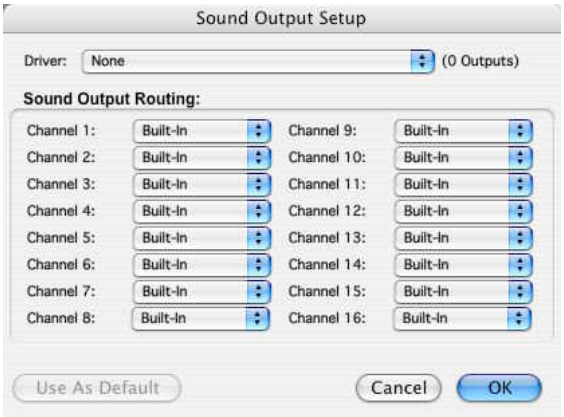
•!On **MacOS X**, install the CoreAudio driver for your device using the installer program that came with the device.

•!On **Windows**, install the ASIO driver for your device using the installer program that came with the device.

Setting Up Multi-Channel Sound

Once you have installed your drivers, run Isadora. Then follow this set up procedure.

- Create a new document or open an existing document. You need to do this because Isadora stores the sound routings with each document, since it is likely that different documents will require different audio routing setups.
- Choose **Output > Sound Output Setup…** to display the Sound Output Setup Dialog. It looks like this:



At the top you will see the **Driver** pop-up menu. Select the device you would like to use for multi-channel output.

If your device is not listed in the pop-up, quit Isadora and make sure that your drivers are properly installed, and repeat the above process.

On MacOS 9, it is important that Isadora can find your ASIO Drivers folder. Often (but not always) there is an ASIO Drivers folder located inside the Extensions folder in your System Folder. See notes about the location of the "ASIO Drivers" folder in the section "Installing Drivers" above.

If you only need to route the sound of movies played by the Movie Player, you can skip this step. Otherwise, if you are using the Sound Player actor to play sound and want to route their output to various channels on the external device, you should set up the routing for Isadora's sixteen sound channels. These channels correspond to the sixteen channels available in the play channel property of the Sound Player actor.

When you change the settings under the **Sound Output Routing** portion of this dialog, you are specifying the pair of outputs to which a particular sound channel should be sent. For instance, if you set Channel 1 to Ext. 1-2 and Channel 2 to Ext 3-4, then sounds played on Isadora's sound channel 1 would appear on channels 1 and 2 of your external device, while sounds played on channel 2 would appear at channels 3 and 4 of your device. Note that you cannot route Isadora's sound channels to only one channel of your output device – you must choose a pair. (You can, however, use the Pan property to send your sound only to one channel or the other.)

- If you would like the current Sound Output settings to be the default when you next create a new document, click the "Use As Default" button. This stores the current routings in your preferences so that new documents will use these settings.
- Click OK to confirm your settings and dismiss the dialog.

Using Multi-Channel Sound with Movies

Isadora allows you to play the movie file's sound output to any pair of outputs on your external device. You can do this by simply choosing the desired output in the snd out property of the Movie Player, Movie Player Direct or Sound Movie Player actors.

When the snd out property is set to std, the movie's sound will be sent to the default sound output device (usually this is your computer's speaker or sound

output jack). To send the sound to a pair of outputs on your multi-channel sound output device, set the snd out property to one of the following values:

E1-2	Outputs 1 and 2
E3-4	Outputs 3 and 4
E5-6	Outputs 5 and 6
E7-8	Outputs 7 and 8
E9-10	Outputs 9 and 10
E11-12	Outputs 11 and 12
E13-14	Outputs 13 and 14
E15-16	Outputs 15 and 16

If you set the snd out property to a pair of outputs that does not exist on your external device, or if the device is not currently connected, then the sound will be sent to the built-in output.

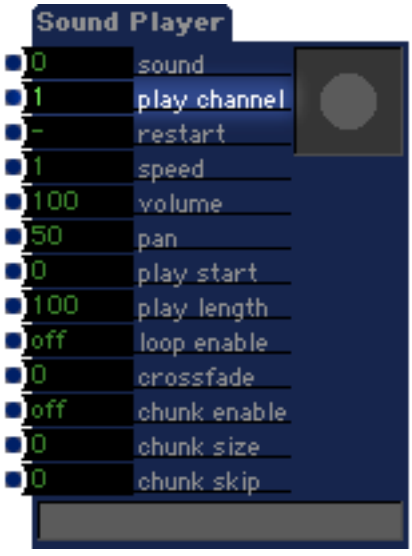
If the movie contains multiple sound tracks, the Movie Player and Movie Player Direct actors will route all sound to the output specified by the snd out property. If you would like to manipulate the volume, pan, and output routing of each track individually, use the Sound Movie Player actor.

Using Multi-Channel Sound with Sound Files

Sound files are sent to one of Isadora's sixteen Sound Channels. Each of these Sound Channels is will play sound either on your computer's built-in sound output (i.e., its speaker or sound output jack) or on a pair of outputs on your external sound device.

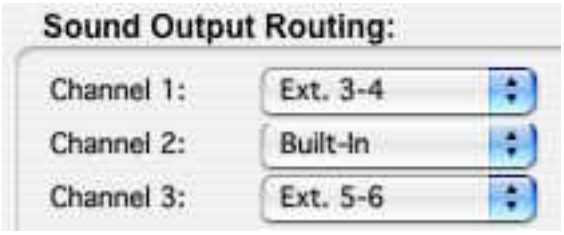
You associate a Sound Channel with a particular pair of outputs using in the Sound Output Routing section of the Sound Output Setup dialog. (See the explanation above under *Setting Up Multi-Channel Sound*.)

When you play sound using the Sound Player, you specify the Sound Channel on which it will play using the play channel property.



Since a Sound Channel is associated with a given pair of outputs, setting the play channel will determine where the sound will be heard.

For example, let's say that you set up the first three channels of the Sound Output Routing as follows:



With this setup, sound files played on Sound Channel 1 will be heard on channels 3 and 4 of your external device; those played on Sound Channel 3 will be heard on channels 5 and 6. Sounds played on channel 2 will be heard on your computers built-in sound output.

Creating a Multi-Channel Audio Movie Using QuickTime Player Pro

QuickTime Player Pro allows you to create QuickTime Movies that have multiple audio tracks. If you import these movies into Isadora, you can use the Sound Movie Player actor to control the volume, panning, and output channel of the individual tracks.

Multi-channel audio movies can be created using the editing functions available in QuickTime Player Pro. (QuickTime Player comes and QuickTime is a free download from Apple. You can upgrade to the Pro version of QuickTime Player by visiting http://www.apple.com/quicktime.)

To create a multi-channel sound movie, follow these steps:

1) Run QuickTime Player Pro.
2) Choose "File > New Player" to create an empty file.
3) Open a sound file by choosing "File > Open File...". (QuickTime Player supports numerous sound formats, including AIFF, WAVE, MP3 and many others). Note, however, that it is probably a good idea to have all of your files stored in the same format at the same sample rate.
4) Choose "Edit > Select All"
5) Choose "Edit > Copy"
6) Then close the audio file by choosing "File > Close"
7) The file you created in Step 2 will now be in front. Click the "Rewind" button (the single triangle pointing left with the bar at the point.)
8) Choose "Edit > Add To Movie"

At this point, you have one sound track in the movie. You can add more tracks by repeating steps 3-8.

9) When you are done adding tracks, choose "File > Save" to save the new file with all of the audio tracks. Note the two options in the Save dialog: "Save as a self-contained movie" and "Save as a reference movie." Generally speaking, it is a good idea to choose "Save as a self-contained movie", as a new file with a copy of all of the audio data you pasted will be created. If you save as a reference movie, then the file only contains links to the original files -- if you delete or move the originals to another folder, you may not be able to open the reference movie.

Once you have created your multi-channel audio QuickTime Movie, you can use the Sound Movie Player actor to control the volume, panning, and sound routing of the individual tracks.

Isadora & CoreAudio (v1.2 - MacOS X Only)

Isadora integrates Apple's CoreAudio architecture, making all of the CoreAudio plugins installed on your system available for use as plugins inside Isadora. (OS X comes with several CoreAudio plugins installed, and there are many more available from third parties.) For documentation on the individual plugins, you should contact the manufacturer of the plugin. This section describes the basic architecture and how to manipulate the sound of both pre-recorded audio files and live input.

All of the CoreAudio plugins will appear in Toolbox Group 2, the Audio Group. They will be listed by the names given them by their manufacturers.

Setting Up for Multi-Channel Sound

If you plan on accessing your multi-channel sound output device with CoreAudio plugins, you must ensure it is set as the default in the Audio MIDI Setup application.

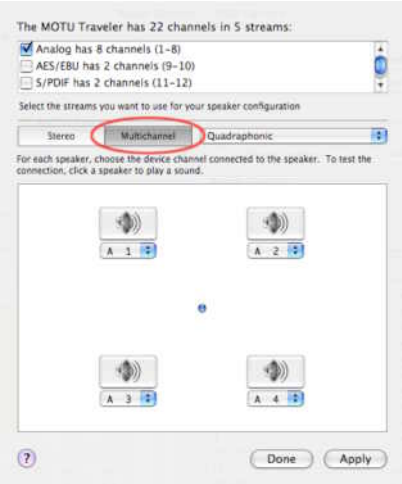
•!On **MacOS X**, install the CoreAudio driver for your device using the installer program that came with the device. Then, after connecting the device, follow these steps:

1) From the Applications folder, double click the Audio MIDI Setup application.
2) Click on the tab "Audio Devices" at the top. The top portion of the window looks like this

3) In the popup menu to the right of "Default Output", select your multi-channel output device.

4) If you want to process live input, select your multi-channel output device in the popup to the left of “Default Input.”

5) If you would like to do sound spatialization, click the “Configure Speakers” button. In the dialog that appears, click the “Multichannel” button.


The MOTU Traveler has 22 channels in 5 streams:
Analog has 8 channels (1-8)
AES/EBU has 2 channels (9-10)
S/PDIF has 2 channels (11-12)
Select the streams you want to use for your speaker configuration
Stereo
Multichannel
Quadraphonic
For each speaker, choose the device channel connected to the speaker. To test the connection, click a speaker to play a sound.
A 1
A 2
A 3
A 4
Done
Apply

6) You can then use the popup menu to the right of the “Multichannel” button to select the output mode. Choices include Quadraphonic, Hexagonal, Octagonal, 5.1 Surround, 6.1 Surround and 7.1 Surround. Click “Done” after you have chosen your setup.

7) Choose **Audio MIDI Setup > Quit**

Manipulating Pre-Recorded Sound - Tutorial

Like the Sound Player, all pre-recorded sounds to be manipulated in Isadora must first be imported into the Audio bin. Once you have some sounds in the Audio Bin, follow these steps for an example of manipulating pre-recorded sound.

1) Click on Toolbox Group 2 to show the actors available in the audio group.

2) Add an AUAudioFilePlayer actor to the scene. Set the sound input to the number of the sound you want to manipulate.

   Note that its output says “audio”. This is like the “video” inputs and outputs seen in Isadora’s video processing actors. Audio is a special type of stream that transmits digital audio signals. You can only connect audio outputs to audio inputs, and vice versa.

3) To the right of the AUAudioFilePlayer, add an AULowpass actor. This is a low-pass filter, with adjustable resonance (i.e., “Q”.)

4) To the right of the AULowpass actor, add an AUMixer actor. This actor allows the volume and panning of multiple sound streams to be manipulated and mixed together.

5) Note the inputs input on the AUMixer. You can add an arbitrary number of input channels to this mixer by changing this value. For our example, we will work with 2, so set the inputs input to 2.

6) To the right of the AUMixer actor, add an DefaultOpututUnit actor. This sends the mixed sound to the default audio output device.

7) Make a link between the AUAudioFilePlayer 's out 1 output and the AULowpass' in 1 input. Then connect the AULowpass' out 1 output to the AUMixer 's in 1 input. Finally, like the AUMixer's out 1 output to the DefaultOutputUnit's in 1 input. As soon as you make this last link, you will hear sound. Note that the AUAudioFilePlayer and DefaultOutputUnit both have properties called active. We will experiment with these momentarily, but suffice to say that because both of these active properties were set to on, connecting the last link caused sound to automatically start playing.

8) Add a Mouse Watcher to the scene. Connect the horz pos output to the cutoff frequency input of the AULowpass, and the vert pos output the resonance input.

9) Turn the volume of your sound system to a medium level –!the low-pass filter can make very loud sounds when the resonance is high.

10) Finally, click the start input of the Default Output Unit. You should hear your sound playing. Moving the mouse will change the cutoff frequency and resonance of the low-pass filter, affecting the sound's timbre.

11) You can also experiment with changing the volume 1 and panning 1 inputs of the AUMixer actor.

12) To mix two sounds, add another AUSoundPlayer actor to the scene, and connect it's out 1 output to the in 2 input of the DefaultOutputUnit. Then click the start input of the DefaultOutputUnit. You will now hear both sounds, and can control the volume and panning of each using the volume and panning inputs of the AUMixer actor.

13) The DefaultOutputUnit's active property controls the entire change of audio actors connected to that output unit. Change this property to off you will see that all sound will stop. Change it back to on and both sound files will start playing again.

14) Now try changing the active property of both AUAudioFilePlayers. You will see that you can use this property to start or stop the sound file playback independently.

As you can see, using the CoreAudio filters to perform real-time manipulation of sound is very much like using the video filters that have been part of Isadora since the beginning.

Spatialized Sound - Tutorial

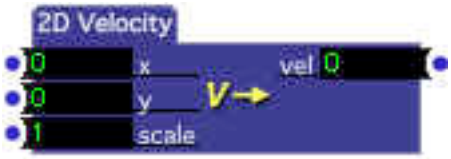
CoreAudio offers the ability to spatialize sound, that is, to move it in and around the space between your speakers. Using the previous tutorial as an example.

Note that if your default audio output (as specified in the Audio MIDI Setup application) is stereo (i.e. two speakers), the AUMixer3D will simulate movement of the sound in three dimensions – this is best experienced with headphones. If you have more than two outputs (e.g. a quadraphonic speaker setup), AUMixer3D will spatialize the sound within the field of that speaker configuration.

1) Click on Toolbox Group 2 to show the actors available in the audio group.
2) Add two AUAudioFilePlayer actors to the scene. Set the sound input of both actors to the number in the Audio Files Bin of the sounds you want to play.
3) To the right of the AUAudioFilePlayers, add an AUMixer3D actor, and set its inputs input to 2. This actor allows you to control the volume, azimuth, elevation and distance of each sound stream, measured relative to the central point in the current speaker configuration. (Which you selected in the Audio MIDI Setup application.)
4) To the right of the AUMixer3D , add an DefaultOpututUnit actor. This sends the mixed sound to the default audio output device.
5) Make links between the AUAudioFilePlayers' audio outputs and the AUMixer3D's audio inputs. Connect a link from the AUMixer3D's audio output to the DefaultOutputUnit's audio input. As soon as you make this last link, you will start to hear both sounds playing.
6) Try adjusting the various parameters on the AUMixer3D. Changing the azimuth should move the sound in a circle around the central point. Changing the elevation may give a sense of the sound going above or below you (not audible in certain speaker configurations.) Finally, the distance controls the apparent distance of the sound from the center point. Higher numbers make the sound get softer, i.e., it is moving away from you.
7) Set the active input of the DeafultOutputUnit to off the sound.

Actors Reference

2D Velocity (v1.1)



Calculates the velocity of a point as it moves in 2D space.

This module calculates the velocity of a point in 2D space, as specified by its x and y coordinate. Each time a new value is received at the **y** input, the current x/y values and the previous x/y values are used to calculate the velocity.

The velocity is actually the result of the standard formulate for the distance between two points, i.e., the square root of $((x2 – x1)^2 + (y2 – y1)^2)$, where x2 /y2 is the current point and x1/y1 is the previous point.

One possible use of this module is to measure the velocity of the movements of the mouse. Try connecting the Mouse Watcher's horizontal and vertical outputs to the **x** and **y** inputs of the 2D Velocity module for an example.

Input Properties

- **x:** The x coordinate of the point
- **y:** The y coordinate of the point.
- **scale:** The scaling factor. Each time a new velocity is calculated, it is multiplied by this number to determine the final velocity.

Output Properties

- **vel:** The velocity of the point as it moves.

3D Projector (v1.1)

A projector with the capability to rotate and translate the image in three dimensions, and to create multiple copies of the image that automatically move in space.

This actor only works when **Hardware Accelerated Rendering** is turned on in the Preferences

This module share many input properties with the standard Projector actor, but has can do more manipulations of the image in 3D space.

Its other main feature is the ability to multiple copies of the image, and have them move through space. This is accomplished by setting the object count to a value higher than 1 and triggering the add obj input. Once you do this, a copy of the current frame will drift away from its original location at a rate determined by the x/y/z offset inputs.

Input Properties

- **video in:** The video stream to be rendered

- **stage:** The stage on which the image will appear
- **visible:** When turned on, the video is rendered to the stage. When turned off, the video is not rendered (which also reduces the processor load).
- **layer:** Determines the order in which this actor will be rendered, in relation to any other 3D actors in the scene (other 3D Projectors, 3D Player, 3D Quad Distort, etc.) Higher numbered layers are "in front" of lowered numbered layers, i.e., they are drawn last.
- **blend:** Determines the opacity of the video image in conjunction with the intensity input. When set to additive, the image is added to the background image – lower intensity settings reduce the brightness of the image. When set to transparent, lower intensity values make the object more transparent, allowing you to see more of the image underneath. When set to opaque, lower intensity values will fade the image to a black background that obscures the background image.
- **intensity:** Sets the brightness or transparency of the image, from 0 to 100%. See blend input for a complete description.
- **render back:** When turned off, the image is only rendered on the front side of the plane. This means that if you rotate the image, it may become invisible when viewed from the back. When turned on, the image is rendered on both the front and back side.
- **zoom:** Scales the image, from 0 to 1000% of its normal size.
- **obj count:** When creating multiple copies of the frame using the add obj input, determines the maximum number of objects that can be created. How long each object will actually be visible is determined by the lifespan input.
- **lifespan:** Determines how long an object will live after it has been created by triggering the add obj input. An object grows darker and/or more transparent (depending on the blend input) as it approaches the end of its lifespan.
- **brt override:** Used when created multiple copies of the image to override the brightness of objects as they grow older. For example, if the lifespan of the objects is two seconds, and a particular object is one second old, it would normally be 50% brightness. But, if you set the brt override to 1 sec, this object would be rendered at 100% brightness. How many objects the override will affect is determined by the override wid input.
- **override wid:** Used in conjunction with brt override input, this value determines how far the brightness override will extend. Setting this to a higher value means that the brightness of more objects will be affected.
- **x/y/z rotation:** Rotates the image around its x, y or z axis.
- **x/y/z translate:** Translates the image along the x, y or z axis.
- **x/y/z offset:** When creating multiple copies of the frame using the add obj input, these values determine how far the new object will travel along each axis each second.
- **x/y/z :** The location in space of the center of the image.

- **add obj :** Each time this input is trigger, a copy of the image is created. It will travel along the x/y/z axes at the speed set by the x/y/z offset inputs, and decay towards being black or fully transparent over the duration set by the lifespan input.

3D Quad Distort (v1.1)

A projector with the capability to rotate and translate the image in three dimensions as well as to independently stretch all four corners of the image.

This actor only works when **Hardware Accelerated Rendering** is turned on in the Preferences

Input Properties

- **video in:** The video stream to be rendered
- **stage:** The stage on which the image will appear
- **visible:** When turned on, the video is rendered to the stage. When turned off, the video is not rendered (which also reduces the processor load).
- **layer:** Determines the order in which this actor will be rendered, in relation to any other 3D actors in the scene (other 3D Projectors, 3D Player, 3D Quad Distort,

etc.) Higher numbered layers are “in front” of lowered numbered layers, i.e., they are drawn last.

- **blend:** Determines the opacity of the video image in conjunction with the intensity input. When set to additive, the image is added to the background image – lower intensity settings reduce the brightness of the image. When set to transparent, lower intensity values makes the object more transparent, allowing you to see more of the image underneath. When set to opaque, lower intensity values will fade the image to a black background that obscures the background image.
- **intensity:** Sets the brightness or transparency of the image, from 0 to 100%. See blend input for a complete description.
- **render back:** When turned off, the image is only rendered on the front side of the plane. This means that if you rotate the image, it may become invisible when viewed from the back. When turned on, the image is rendered on both the front and back side.
- **zoom:** Scales the image, from 0 to 1000% of its normal size.
- **x/y/z rotation:** Rotates the image around its x, y or z axis.
- **x/y/z translate:** Translates the image along the x, y or z axis.
- **x1/y1:** Offsets the top left corner of the image. Negative values make the corner move left (x) or up (y); positive values make the corner move right (x) or down (y).
- **x1/y1:** Offsets the top left corner of the image. Negative values make the corner towards the center, positive values move the corner away from the center
- **x2/y2:** Offsets the top right corner of the image.
- **x3/y3,** Offsets the bottom left corner of the image.
- **x4/y4:** Offsets the bottom right corner of the image.

3D Player

Positions, rotates, and/or scales a 3D object for rendering by a 3D Renderer actor.

This actor only works when **Hardware Accelerated Rendering** is turned on in the Preferences

The first step in displaying a 3D object is to import the object's model (which must be in the 3D Studio Max 3DS format) into the Media Window. If the 3DS files uses a texture map, the image file must be in the same folder as the 3DS file that references it.

Then you need at one or more 3D Player actors and a 3D Renderer actor in the same scene. Each 3D Player actor will show one object on a specified rendering channel. If you have multiple 3D Player actors set to the same channel, then the 3D Renderer set to that channel will render all of those objects. The resulting image will be output as a video stream by the 3D Renderer, which can be sent to another Isadora video processing actor, or directly to a Projector actor.

For example, let's say you have two files: Cube.3ds and Wedge.3ds. You import these into the Media Window. Then, you create a scene with two 3D Players and one 3D Renderer. All have their channel input set to 1. After connecting the 3D Renderer's video output to a Projector and showing the Stage, you can adjust the translation parameters of the 3D Players so that you can see the two objects.

Note the texture map input: if you leave this input disconnected, then the object will be rendered with the texture map referenced in the 3DS file (if any). If you connect

a video stream to this input, the video will be texture mapped on to the object in real time.

Input Properties

- **3D object:** Specifies the number of the 3D object file, as displayed in the Media Window.
- **stage: (v1.1)** When turned off, the 3D object will be rendered to the 3D Renderer actor rendering on the same channel as specified by the **channel** input. When turned off, the object is rendered directly to the stage specified by the **channel** input.
- **channel:** The channel on which the object will be rendered. When the **stage** input is set to off, the 3D object will be rendered to the 3D Renderer object in this scene whose **channel** matches the one specified here. When the **stage** input is on, the object will be rendered to the stage specified by this number; i.e., 1 = Stage 1, 2 = Stage 2, etc.
- **visible:** When on, the object is visible and will be drawn.. When off, it is invisible.
- **x/y/z rotation**: Rotates the object around the x, y, or z axes by the number of degrees specified.
- **x/y/z translation**: Translates the object along the x, y, or z axes by the number of degrees specified.
- **all scale**: Scales the object in all three dimensions equally by the specified percentage of its original size.
- **x/y/z scale:** Scales the object in the x, y, or z dimension by the specified percentage.
- **texture map:** If a video input is provided to this input, texture maps the incoming video on to the object in real time.
- **tex map scale:** Scales the texture map by the specified percentage.
- **use alpha: (V1.1)** When turned on, the alpha channel information embedded in the video stream will be used when rendering the 3D object. (See the **Add Alpha Channel** actor for more information about alpha channels.)

3D Renderer

Renders all 3D Objects on the specified rendering channel.

This actor only works when **Hardware Accelerated Rendering** is turned on in the Preferences

This actor controls both which objects it will render, and the position of the "camera" looking at those objects.

The channel input determines which objects will be rendered: only objects displayed on the same channel by a 3D Player actor will be seen by this renderer. The other parameters control the positioning of the camera in space and, thus, how the objects appear in the resulting rendered video output. You can theoretically have up to 4 separate 3D Renderers in the same scene, each set to a different channel. How many you can really run simultaneously will depend entirely on the speed of your computer and on the speed of your 3D rendering hardware (the computer's video card).

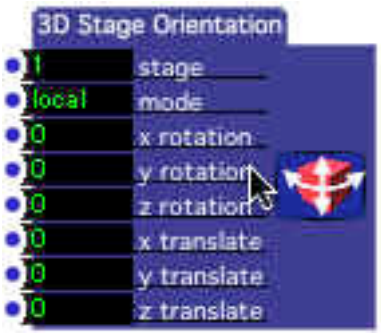
See the discussion under the 3D Player object for more information on setting up and rendering 3D Objects in Isadora.

Properties

- **channel:** Determines which 3D Objects will be rendered by this actor. Only a 3D Players set to the same channel as specified here will have their objects drawn by this Renderer.
- **horz/very size:** Specifies the size of the rendering surface in pixels. 320 by 240 is a reasonable compromise between speed and detail. You may notice slower performance when using a setting like 640 by 480.
- **force 4:3:** When this parameter is on, changing the value of either the horz or vert size input will automatically adjust the other input so that the ratio between horizontal and vertical is 4:3.
- **x/y/z rotation**: Rotates the camera around the x, y or z axes by the number of degrees specified.

- **x/y/z translation**: Translates the camera along the x, y, or z axes by the number of degrees specified.

3D Stage Orientation (v1.1)



Determines the x/y/z rotation and translation of the camera for a specified stage.

This actor the position of the "camera" looking at all 3D Object being rendered to a particular stage. This is used in tandem with the 3D Player actor when its **stage** input is turned **on**.

Properties

- **stage**: the stage for whose rotation and translation will be set.
- **mode**: when set to local, orientation changes will affect this scene only. When set to global, changes affect all scenes.
- **x/y/z rotation**: Rotates the camera around the x, y or z axes by the number of degrees specified.
- **x/y/z translation**: Translates the camera along the x, y, or z axes by the number of degrees specified.

Absolute Value (v1.1)

Outputs the absolute value of the number received at the input.

Input Properties

- **in:** The input value

Output Properties

- **out:** Outputs the absolute value of the input value.

Activate Scene

Activates a secondary Scene in addition to the primary active scene.

When you activate a secondary scene, all of the actors in the currently active Scene and all of the actors in the newly activated secondary Scene will run at the same time. A Scene activated through the Activate Scene actor will remain active until 1) you deactivate it using the Deactivate Scene actor, 2) you make the secondary scene primary by jumping into it using the Jump actor, or 3) if you make it primary by clicking on it in the Scene List with the mouse.

Secondary scenes are indicated as active in the Scene List by being drawn in a light blue color, as opposed to the deeper blue used to indicate a primary active Scene. In the picture below, scene “one” is primary, and scene “three” is secondary.

Properties

- **trigger**: When a trigger is received on this input port, the secondary Scene indicated by the **mode** and **scene** properties is activated.
- **scene**: Indicates which Scene to activate. This field works in tandem with the mode field. When mode is set to relative, the number in this field indicates the scene to activate relative to the current scene. +1 would be the scene after this scene, -1 would be the scene before this scene, +2 would be the second scene after this scene, etc. When mode is set to absolute, the number in this field indicates a Scene in the Scene List by its position, where 1 is the first scene in the list, two is the second scene, etc.

  When a valid scene has been specified in this property, its name will appear after the number.
- **mode:** Determines how the number in the **scene** property is interpreted. When this property is set to *relative* the scene to be activated is relative to the position of the current scene in the Scene List. When this property is set to *absolute* the Scene to be activated is based on its position in the Scene List. See **scene** property above for more information.
- **fade: (V1.1)** Specifies a fade time, over which the video and audio in the newly activated scene will be faded in. (Note: The visual aspect of the fade in will only work if Hardware Accelerated Rendering is turned on in the Video tab of the Preferences.) The visual result of the fade in depends on a number of factors: what video is being rendered in the current scene, the setting of the blend and layer inputs in the Projector actors that become active, etc. See the section

"Compositing with the Projector using Hardware Accelerated Rendering" on Page 144 for more information on taking advantage of multiple projectors.

Activate Scene Amount (v1.1)

Activates a secondary Scene at a specific intensity in addition to the primary Scene.

This actor is similar to the Activate Scene actor, except that it allows you set intensity of the Secondary Scene, i.e., the brightness of the video and the volume of the sound.

The setting of the intensity input determines whether or not the secondary Scene is active. When the intensity is 0, the secondary scene is not active. When intensity rises above 0, the secondary scene is activated, and its intensity set the appropriate value.

Please refer to the Activate Scene actor for a more complete description of Secondary Scenes.

Properties

- **mode:** Determines how the number in the **scene** property is interpreted. When this property is set to *relative* the scene to be activated is relative to the position of the current scene in the Scene List. When this property is set to *absolute* the Scene to be activated is based on its position in the Scene List. See **scene** property above for more information.
- **scene**: Indicates which Scene to activate. This field works in tandem with the mode field. When mode is set to relative, the number in this field indicates the scene to activate relative to the current scene. +1 would be the scene after this scene, -1 would be the scene before this scene, +2 would be the second scene after this scene, etc. When mode is set to absolute, the number in this field indicates a Scene in the Scene List by its position, where 1 is the first scene in the list, two is the second scene, etc.

  When a valid scene has been specified in this property, its name will appear after the number.
- **intensity**: The setting of the intensity input determines whether or not the secondary Scene is active. When the intensity input is 0, the secondary scene is not active. When intensity rises above 0, the secondary scene is activated, and its intensity is set the appropriate value.

- **auto deac:** When this input is turned on, the Secondary Scene will automatically be deactivated when leaving the current scene. When turned off, the secondary Scene will remain active even after you leave this Scene – you must explicitly deactivate the scene by setting the intensity property of a another Activate Scene Intensity actor to 0, or by using the Deactivate Scene actor.

Add Alpha Channel (v1.1)

Embeds an alpha channel into a video stream, which can be used by the Projector actor when rendering the video to a Stage.

By embedding an alpha channel into a video stream, you can control the transparency of each pixel as it is rendered to the stage. This feature only works if **Hardware Accelerated Rendering** is turned on the Video tab of the Preferences.

When the Projector renders to the stage using hardware acceleration, it uses the embedded alpha mask information to determine the transparency of the video stream being rendered. Where the mask is white you will see the original video stream, where the mask is black you will see the anything that has been rendered to the stage previously (i.e., in a lower layer). When the brightness of the mask is a shade of gray you will see a mix of the original video stream and previously rendered images – how much of the background you will see is based on the mask's brightness. When the mask is light, you will see more of the foreground; where it is dark, you will see more of the background. Below are examples foreground, background, and mask image, and the result of combining them through the alpha mask

See the section "Compositing with the Projector using Hardware Accelerated Rendering" on Page 144 for more information on taking advantage of these features.

Input Properties

- **video**: the video stream into which the alpha channel will be embedded.
- **mask**: a video stream that will become the alpha mask. This stream does not have to be in grayscale, but it will be converted to a grayscale image before it is embedded into the source video stream.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **video out**: the video stream into which the alpha channel has been embedded.

All Notes Off

Sends a MIDI Note Off message to all currently sounding notes on all MIDI Output Ports.

Isadora keeps track of what how many Note On messages have been sent to each MIDI channel on each MIDI Output Port, so that it only sends the messages it needs to turn off all of the currently sounding notes. This is different than the MIDI Panic actor, which sends a Note Off messages for every possible MIDI Note on all of the ports.

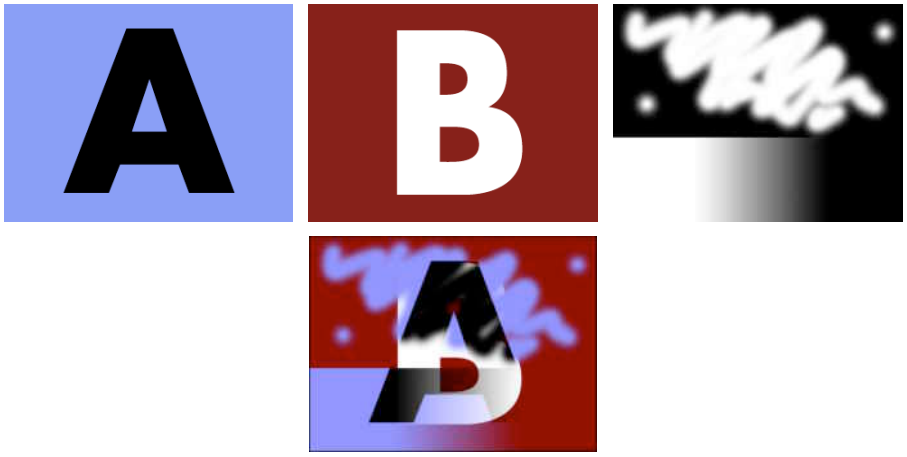
Properties

- **all notes off**: when a trigger is received on this input port, MIDI Note Off messages are sent to silence all currently sounding MIDI Notes.

Alpha Mask

Mixes two video streams together using the brightness of a third video stream to determine whether you see the foreground or background or a mixture of the two.

Where the **mask** video stream is white you will see the foreground video stream, where it is black the background. When the brightness of the mask is a shade of gray you will see a mix of the foreground and background images based on the mask's brightness. When the mask is light, you will see more of the foreground; where it is dark, you will see more of the background. Below are examples foreground, background, and mask image, and the result of combining them through the alpha mask



You can that where the mask is light you see the blue background and the dark letter A. Where it is dark, you see the red background and the light letter B. Look along the bottom of the mask – there is a gradation that goes gradually from white to black in the middle portion. In the resulting image, you can see how that part of the image "fades" from the foreground to the background.

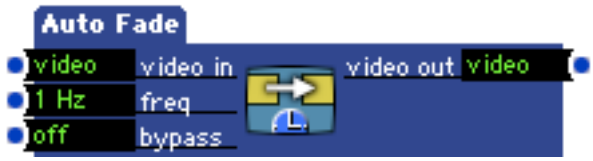
Input Properties

- **foreground:** a video stream that will become more visible as the corresponding area in the mask approaches white.
- **background:** a video stream that will become more visible as the corresponding area in the mask approaches black.
- **mask**: a video stream that determines whether you see the foreground or background image. Where the mask is white, you will see only the foreground image. Where it is black, you will see only the background. When the mask is a color or shade of gray, you will see a mixture of the foreground and background, showing more of the background as the mask approaches black.
- **strength**: when this value is set to 100%, the mask functions normally. When set to a lower value, you will see more of the foreground. (The internal effect is that the mask is lightened as the strength decreases.) By ramping this value from 0 to 100 you can fade in the mask, by ramping from 100 to 0 you can fade it out.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **video out:** the masked video stream.

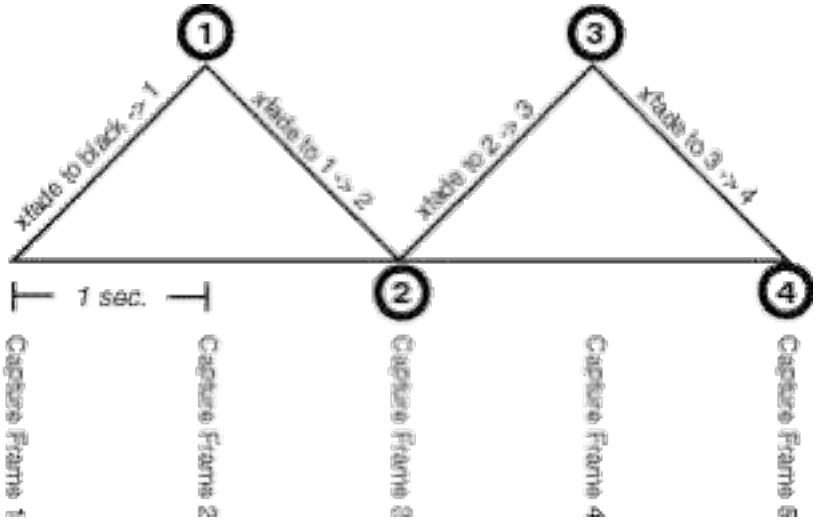
Auto Fade



Automatically crossfades between still images captured from a video stream.

Auto Fade works by capturing still images from the incoming video stream, and cross fading between them at a specified frequency. The result is a rather dreamlike stop-motion effect. Different settings of the 'freq' input produce very different results.

The diagram below shows how the process works. But probably, it is best to simply try the actor to see the results. The circled numbers show when those captured frames of video are fully visible.



Input Properties

- **video in:** The video input stream.
- **freq**: Specifies the rate at which still frames will be captured from the incoming video stream, and the rate at which Auto Fade will cross fade between those images.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Input Properties

- **video out:** The video input stream.

Background Color

Generates a video stream with a solid color.

The resolution of the output video is determined by the default pixel resolution specified in the Video Tab of the Preferences. If you want to generated a background color at a different horizontal and/or vertical resolution, use the Resizable Bkg actor.

Input Properties

- **bkg color**: This determines the color of the output video stream. There are two ways to specify the color: first, if you click on the colored square to the left of the title bkg color, a standard color picker dialog will appear. Or, you may connect the output of the Color Maker actor to the bkg color input.

Output Properties

- **video out**: Outputs a video stream at the default resolution defined in the Video tab of the Preferences.

Broadcaster

Sends a value of any type to all active Listener actors listening on the specified channel.

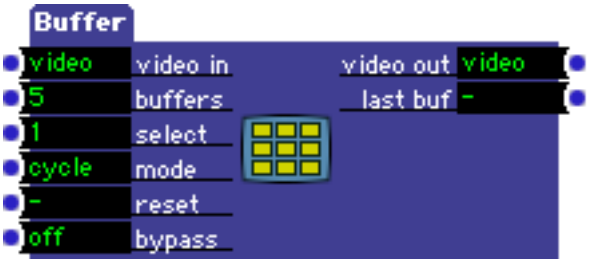
Broadcasters are primarily used to send values between the primary active Scene and a secondary active Scene. (See the Activate Scene actor for more information on secondary Scenes, or the Net Broadcaster to send values to other machines on a Local Area Network.) Whenever a new value is received at the value input, that value is “broadcast” to all active scenes on the channel specified by the channel input property. Any active Listener actor that is set to receive on the same channel will “hear” the value and send it out of its value output.

You can however use the Broadcaster/Listener pairs within the same scene if desired, since values are broadcast to *all* active scenes.

Properties

- **channel**: Specifies the channel on which this value will be broadcast. Only Listener actors whose channel input property are set to the same value as that specified by this property will “hear” the broadcast.
- **value**: Whenever a value is received at this input, it is broadcast on the channel specified by the channel input property. Note that his input is mutable, in that it will change its type (integer, float, video, etc.) to match that of the output property to which it is linked.

Buffer

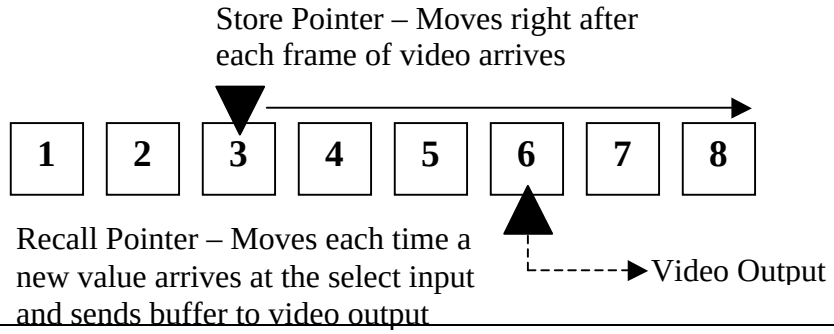


Captures an arbitrary number of frames of video, allowing them to be recalled in any order and at any rate.

You can visualize the buffer as an ordered list of video frame buffers and two pointers into that list: a store pointer and a recall pointer.

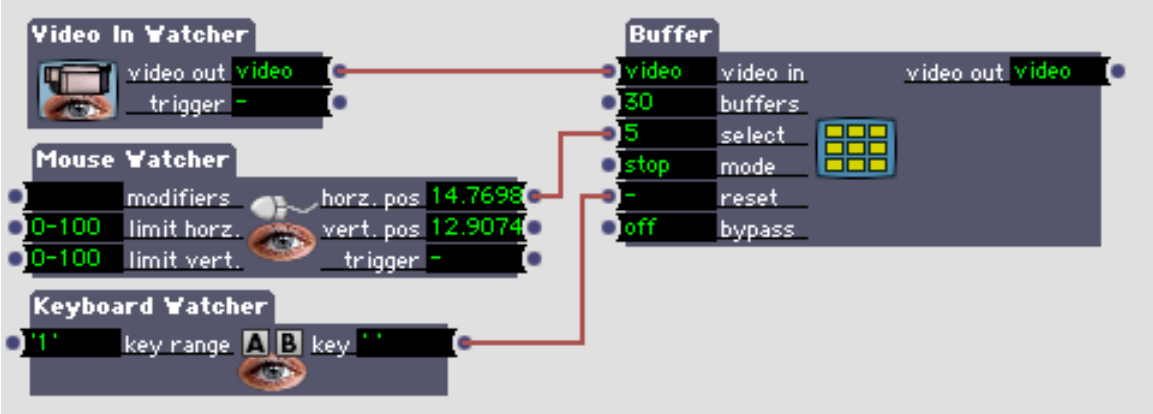
The store pointer (maintained internally) determines where the next frame of video will be stored – it automatically moves to the next buffer in the list each time a new frame of video arrives at the video in input.

The recall pointer moves based on the values arriving at the select input. By sending a buffer number to the select input, you can send the contents of that buffer to the video output. Because each buffer stored in the computer’s RAM and not on disk, recall is almost instantaneous.



What the store pointer does when the last buffer in the list is reached depends on the setting of the mode input. If it is set to cycle, Buffer will continue to store incoming video, starting over with the first buffer (this erases that buffer's previous contents.) If set to stop, Buffer will stop after storing the last frame and wait until the reset input is triggered before starting again from the first buffer.

One interesting use comes when Buffer stores frames from a live video feed from the Video In Watcher, as you are able to manipulate images that occurred live just moments before. To see this in action, try the following patch:



Each time you press the number '1' on the computer keyboard, the buffer actor will capture 30 frames of video from the live input. Note that since the mode is set to stop, when all buffer frames have been stored, the Buffer actor will stop and wait for another trigger. You can then move the mouse horizontally to scrub through the stored images.

Input Properties

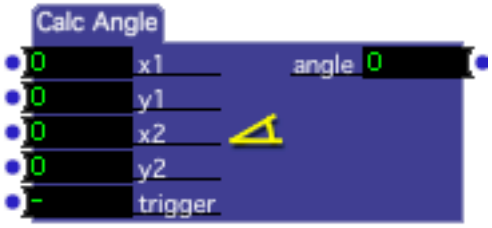
- **video in:** The video input stream.
- **buffers:** The number of buffers (i.e. frames of video) that this actor can store. Note that each frame requires a fair amount of memory, so setting this value to a high number will consume considerable free memory.
- **select**: Selects which buffer to send to the output, from 1 to the number of buffers specified by the buffers input property. When this value changes, the contents of the specified buffer are sent to the video output. If no video has been stored into the buffer you have selected, a black frame will be sent to the output.
- **mode**: Determines what happens when a frame of video is stored in the last buffer in the list. When set to cycle, the buffer continues storing frames, starting over with the first buffer. When set to stop, the buffer stops storing frames until a trigger is received at the reset input.
- **reset**: Resets the Buffer actor so that the next frame of video will be stored into the first buffer in the list. If the mode property is set to stop, triggering this input will cause Buffer to capture frames again until the last buffer is reached.

- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **video out:** Whenever the select input is changed, outputs the frame of video stored in the specified buffer.
- **last trig:** Sends a trigger when the last buffer in the list is stored. This is most useful when the mode input is set to stop, as it allows you to trigger an action when all frames in the buffer have been filled.

Calc Angle (v1.1)



Given a pair of x/y coordinates, outputs the angle between the two points.

Input Properties

- **x1/y1**: The x/y coordinate of the first point.
- **x2/y2**: The x/y coordinate of the second point.
- **trigger:** triggers the calculation of the angle and sends the result to the angle output.

Output Properties

angle: Outputs the angle between the two points whenever the trigger input receives a trigger.

Calc Brightness (v1.1)

Calculates the brightness of a video stream, optionally measuring the minimum and maximum brightness to provide automatic scaling.

The Calc Brightness actor is especially useful if you want to determine how much movement is occurring in a live video feed, and to use the amount of movement to interactively control some parameter.

To accomplish this, you connect the Video In Watcher actor to the Difference actor's video in input, and then connect the difference actor's video output to the video in input of the Calc Brightness actor.

For instance, if the camera is looking at a hand, and the hand was moving slightly, the output of the Difference actor would look something like this.

When there is movement, the Difference actor makes more white pixels. When there is no movement, the output of the Difference actor is almost black. Thus, the more movement there is, the higher the value of the brightness output of Calc Brightness.

But even when there is a lot of movement using this technique, the output value will never reach 100 – as that would require a completely white frame. To help get a full range of output, you can use the *auto scaling* feature of Calc Brightness.

Set the auto frames input to the number of frames you want to analyze (e.g., 150 frames is five seconds of 30fps NTSC video.) Then trigger the auto measure input, and have the person or object seen in the video feed move both very slowly and very fast. The auto measure function keeps track of the lowest and highest brightness values measured, and once the measurement is complete, will start automatically scaling its measurements so that the output should go from 0 to 100%.

Input Properties

- **video in:** The source video stream.
- **auto frames**: Specifies how many frames to examine when using the auto measure function (see below)
- **auto measure:** when triggered, measures the brightness of the next *n* frames of video (with *n* being specified by the auto frames input.) The minimum and maximum brightness measured is then used to automatically scale the brightness output for subsequent frames.

Output Properties

brightness: The brightness of the current frame of video, with a black frame yielding a brightness of 0, a white frame yielding a brightness of 100, etc.

Calc MBT

Converts a measure, beat and tick specification into a percentage that can be used to set the play start or play duration parameters of a Midi Player.

The play start and play length properties in the Midi Player actor are specified as a percentage of the MIDI file's total length. There may be times, however, when you want to specify these values in measures, beats and ticks. This actor allows you to convert the time specified in measures, beats and ticks into a percentage appropriate for the Midi Player.

Because each MIDI file may have a different time signature, you need to specify the MIDI file.

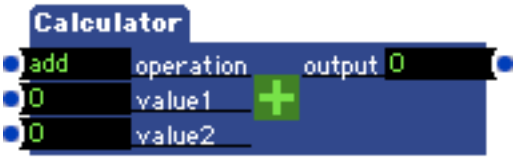
Input Properties

- **midi file**: The number of the MIDI file you want to play, as shown in the Media Window. When the number of a valid movie is entered here, its name will appear to the right of the number. It is important that the MIDI Play to which you are connecting this actor references the same MIDI file.
- **measure:** the measure number, starting with measure 1. If you want to calculate the play length parameter, use the add one to the measure number. I.e., if you want to specify a duration of 6 measures, set this value to 7, because the distance between measure 7 and measure 1 is 6 measures.)
- **beat:** the beat number, from 1 to the numerator of the MIDI file's time signature.
- **tick:** the tick within the beat. The range of this value is specific to the MIDI file that is being referenced.
- **trigger:** sends the resulting percentage to the output.

Output Properties

location: The location within the MIDI file, expressed as a percentage of its total length. You can connect this output to the Midi Player's play start or play length inputs.

Calculator



Performs mathematical calculations on two numeric values.

Properties

- **operation**: Determines the operation to be performed on the two numbers. You may choose *add*, *subtract*, *multiply*, *divide*, or *modulo*. The latter gives the integer remainder when dividing two numbers.
- **value1:** the first value for the operation
- **value2:** the second value for the operation
- **output:** the result of the calculation. For the five different operations, this value is calculated as follows:

add	value1 + value2
subtract	value1 – value2
multiply	value1 x value2
divide	value1 / value2
modulo	integer remainder of value1 / value2

Capture Control

Start or stop capturing video and/or audio.

The Capture Control actor allows you to start or stop live capture interactively. You may choose to start capture video and audio, just video or just audio, and may select the video input used to capture video.

Properties

- **function:** determines the action taken:

vid+aud	start capturing video and audio
vid	start capturing video only
aud	start capturing audio only

none	stop capturing

- **vid input**: Determines which video input will be used to capture.

default	captures from the video driver's default input
composite	captures from the composite video input
s-video	captures from the s-video input
component	captures from the component video input

- **aud input (V1.1)**: Determines which audio input will be used to capture.

default	captures from the video driver's default input
line in	captures from the line input jack
mic in	captures from the built-in microphone
1-4	captures from the device with this index. (Used when you have multiple input devices connected to the system.)

- **size: (V1.1)** Determines the resolution that will be used to capture.

default	captures at the size currently chosen in the Video Capture Size menu.
full	captures at the camera's native resolution
third	captures at one third of the camera's native resolution
half	captures at one half of the camera's native resolution
quarter	captures at one quarter of the camera's native resolution
640x480	captures at one a resolution of 640x480
320x240	captures at one a resolution of 320x240
384x288	captures at one a resolution of 384x288
192x144	captures at one a resolution of 192x144
custom	captures at the size specified by the **Set Custom Capture Size** dialog.

- **trigger**: Starts or stops live capture, based on the setting of the **function** input property.

Capture To Disk

Start or stop recording the current live capture input (video and/or audio) to disk.

The Capture To Disk actor allows you to start or stop recording the current capture input to your computer's hard drive as a QuickTime movie. After capture is completed the newly recorded movie will appear in the Media Window so that you can play it using any of the Movie Player actors.

For more information on how to use this actor see the section “Capturing Video and Audio To Disk” on Page 124.

Properties

- **function:** Determines the action taken:

start	start recording to disk
stop	stop recording to disk

- **movie**: Determines where the recorded movie will appear in the Media Window. When this property is set to add, then the newly recorded movie will be added after the last movie currently in the Media Window. When this property is set to a number, then the movie currently at that location in the Media Window will be replaced by the new movie.
- **trigger**: Starts or stops recording, based on the setting of the **function** input property.

Chop Pixels (v1.1)

Crops a video stream, outputting it at a new resolution.

Chop Pixels will take an incoming video stream, and crop it to s a specified horizontal and vertical resolution. This can be useful in a number of situations; perhaps most notably when you have a high-resolution still image (e.g., 1200x900), and you want to see only a portion of the image (e.g., 320x240). You may also pan within the larger image using the **horz ctr** and **vert ctr** inputs.

IMPORTANT: It is bad practice to use Chopper to scale images to a different size – instead use the Panner or Zoomer actor. The reason for the inefficiency stems from the fact that, when Isadora tries to combine two images of differing resolutions, it will scale one to match the other as specified by the "Video Image Processing" setting in the Video Tab of the Preferences. To get best efficiency when using Isadora, you want to keep all of the video streams the same resolution.

Input Properties

- **video in:** The source video stream.
- **horz res max**: Specifies the horizontal resolution of the output video stream. If this number is greater than the horizontal resolution of the incoming video stream, the resolution of the video stream will be used instead. Note that if the **force 4:3**

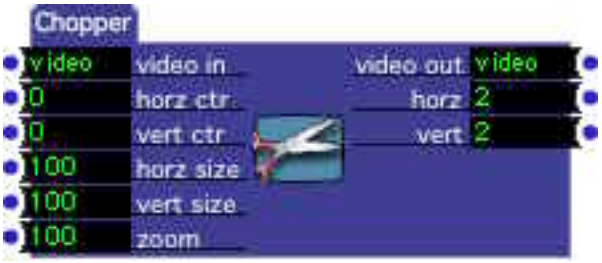
input is turned on, changing this value will automatically update the vert res max so that the horizontal and vertical resolution stays in a 4:3 ratio.

- **vert res max**: Specifies the vertical resolution of the output video stream. If this number is greater than the vertical resolution of the incoming video stream, the resolution of the video stream will be used instead. Note that if the **force 4:3** input is turned on, changing this value will automatically update the horz res max so that the horizontal and vertical resolution stays in a 4:3 ratio.
- **horz ctr**: In tandem with vert ctr, specifies what portion of the incoming image will be seen, from –100 to 100 percent. When set to 0, the cropped image is taken from the center of the incoming video stream. As this number goes negative, you will see more of the left side of the image. As it goes positive, you will see more of the right side of the image.
- **horz ctr**: In tandem with horz ctr, specifies what portion of the incoming image will be seen, from –100 to 100 percent. When set to 0, the cropped image is taken from the center of the incoming video stream. As this number goes negative, you will see more of the top side of the image. As it goes positive, you will see more of the bottom side of the image.

Input Properties

- **video out:** The cropped video stream.

Chopper (v1.1)



Crops a video stream, outputting it at a new resolution that is a percentage of the original resolution.

Chopper works in a manner very similar to **Chop Pixels** in that it allows you to crop an incoming video stream and output it at a new resolution. The difference between Chopper and Chop Pixels is that, instead of specifying a specific output resolution, the final output resolution is specified as a percentage of the incoming video stream's resolution and combined with a zoom factor.

For example, let's say the incoming video stream has a resolution of 320x240. If the horz size and vert size were set to 50%, and the zoom input was 100%, then the output resolution would be 160x120. If you were to change the zoom to 50%, then the resulting resolution would be 80x60 (i.e., 50% of 160x120.) If zoom was 200%, you would get a 320x240 output.

IMPORTANT: It is bad practice to use Chop Pixels to scale images to a different size – instead use the Panner or Zoomer actor. The reason for the inefficiency stems from the fact that, when Isadora tries to combine two images of differing resolutions, it will scale one to match the other as specified by the "Video Image Processing" setting in the Video Tab of the Preferences. To get best efficiency when using Isadora, you want to keep all of the video streams the same resolution.

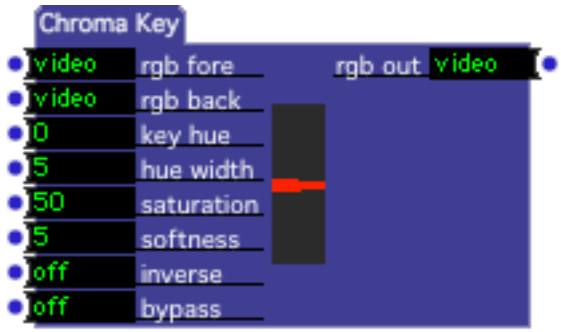
Input Properties

- **video in:** The source video stream.
- **horz ctr**: In tandem with vert ctr, specifies what portion of the incoming image will be seen, from –100 to 100 percent. When set to 0, the cropped image is taken from the center of the incoming video stream. As this number goes negative, you will see more of the left side of the image. As it goes positive, you will see more of the right side of the image.
- **horz ctr**: In tandem with horz ctr, specifies what portion of the incoming image will be seen, from –100 to 100 percent. When set to 0, the cropped image is taken from the center of the incoming video stream. As this number goes negative, you will see more of the top side of the image. As it goes positive, you will see more of the bottom side of the image.
- **horz size**: In tandem with the vert size and zoom inputs, determines the horizontal resolution of the output video stream as a percentage of the incoming video stream's resolution.
- **horz size**: In tandem with the horz size and zoom inputs, determines the vertical resolution of the output video stream as a percentage of the incoming video stream's resolution.
- **zoom**: In tandem with the horz size and vert size inputs, determines the horizontal and vertical resolution of the output video stream by zooming the cropped portion of the image by 0 to 1000%. Internally, the resolution of the incoming video stream that will be seen is determined by the horz size and vert size parameters. The result of this crop is then scaled by the zoom factor, which determines the final output resolution. (See description above for more examples.)

Input Properties

- **video out:** The cropped video stream.
- **horz:** The horizontal resolution of the output video stream.
- **vert:** The vertical resolution of the output video stream.

Chroma Key



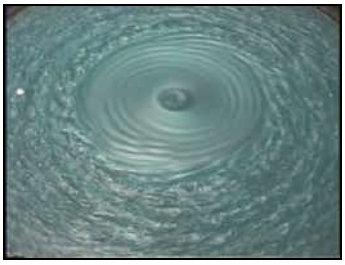
"Keys" two video streams together, allowing the background video stream to show through on the foreground wherever the foreground matches a specified color or range of colors.

The Chroma Key module uses the color of the foreground image to determine whether you see the foreground or background video stream at the output. This can be commonly seen on television when the person delivering the weather appears to be standing in front of a giant weather map. The person is actually in front of a pure blue or green screen, and map is *keyed* into the blue or green area creating the illusion.

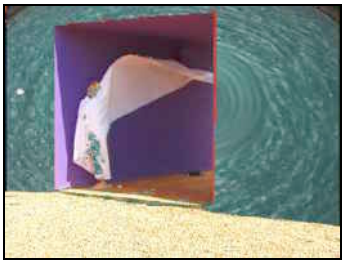
In the Chroma Key actor, you determine the color to match by adjusting the key hue property. The range of colors that will trigger the key is set by the hue width property, and how saturated or pure the color must be is specified by the saturation. The sharpness of the edge between the foreground and background image can be adjusted using the softness property.

Here is an example.

Foreground



Background



Output

For this example the red background of the wall provides a good solid color that we can use to key the background image onto the foreground. Red translates to value of 0 in the key hue property. The hue width was set to 10, and the saturation was set to 66. Wherever the foreground image is red, the background image shows through in the result. The edges between the foreground and background images is softened somewhat because we set the softness property to 10.

To help you understand what these values mean as you are working, there is a diagram displayed in the center of the actor that represents the key hue, hue width and softness properties. (Saturation is not represented in the graph.) For the example actor at the top, you can see that the hue color is green and the width is fairly narrow. The slope at the top and the bottom represents the softness property.

Chroma Keys are tricky, and it can be difficult to get a clean key unless the key color in the foreground video stream is quite pure and evenly lit. On the other hand, you can get lovely effects by misusing this module, using setting the hue width and softness properties to very high values, such that you get a strange blend between the foreground and background images. The most important requirement to get the best results with this actor is a lot of experimentation with the property values.

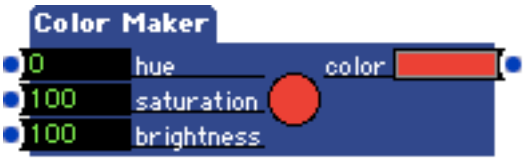
Input Properties

- **rgb fore**: The foreground video stream. Areas of this stream will be seen when its color does not fall within the key color specified by the key hue, hue width, and saturation properties. If this stream is YUV, it will automatically be converted to RGB.
- **rgb back**: The background video stream. Areas of this stream will appear superimposed on the foreground when the foreground color matches the key color specified by the key hue, hue width, and saturation properties. If you do not connect any video stream to this input, it defaults to a black background. If this stream is YUV, it will automatically be converted to RGB.
- **key hue:** Specifies hue of the color that will trigger the key, from 0 to 360.
- **hue width:** Determines the range of hues that will that trigger the key. If you have a very clear, evenly lit color on which you want to key in the foreground, you should be able to set this value fairly low – in the range of 5 or so. Otherwise, you may have to increase this value to get a workable key.
- **saturation**: Specifies how saturated a color must be to trigger the key. Setting this to high values requires that the color on which you want to key in the foreground be almost pure, i.e., have very little white in it. Lowering this value allows less pure (i.e., more pastel) colors to trigger the key.
- **softness**: Determines how “hard” the edge between the foreground and background images is. Experiment to see what setting looks best.
- **inverse**: When turned off, the key functions normally. When on, the key is inverted, i.e., where the foreground matches the key hue and saturation, the foreground image is shown, where it doesn’t, the background image is shown. Turning this property on can be useful if you intend to use the Chroma Key module in coordination with the Eyes video tracking module, as only the object with the matching color will appear at the output.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **rgb out**: The resulting keyed video image in RGB Format.

Color Maker



Creates a color by specifying its hue, saturation, and brightness.

The color output of this module can be connected to actors that have a color input, such as the **Video Fader** actor. As you adjust the input property values, the resulting color is displayed in the round area in the center of the actor.

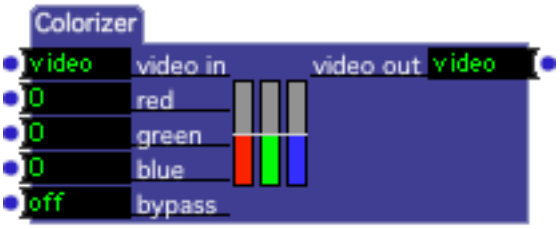
Properties

- **hue**: The hue of the color, ranging from 0 to 360 degrees. Values to achieve some of the primary colors are:

Red	= 0
Yellow	= 60
Green	= 120
Aqua	= 180
Blue	= 240
Purple	= 300
Red	= 360

- **saturation**: The purity of the color. 100 results in a pure color, lower values add more white to the color, moving it towards a pastel.
- **brightness:** The brightness of the color. 100 is as bright as possible. Lower values yield darker colors, with a value of 0 giving black.

Colorizer



Adjusts a video stream's color by increasing or decreasing the red, green and/or blue components of that stream.

The **red**, **green**, and **blue** input properties can be individually adjusted from –100 to 100: a negative setting reduces the amount of that particular color; a positive setting increases it. Some examples:

Original

Red = 0
Green = –25
Blue = –100

Red = 100
Green = –50
Blue = 0

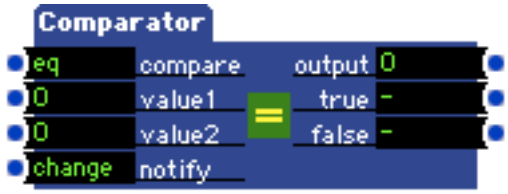
Properties

- **hue**: The hue of the color, ranging from 0 to 360 degrees. Values to achieve some of the primary colors are:

Red	= 0
Yellow	= 60
Green	= 120
Aqua	= 180
Blue	= 240
Purple	= 300
Red	= 360

- **saturation**: The purity of the color. 100 results in a pure color, lower values add more white to the color, moving it towards a pastel.
- **brightness:** The brightness of the color. 100 is as bright as possible. Lower values yield darker colors, with a value of 0 giving black.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Comparator



Compares two numbers.

Input Properties

- **compare**: Determines the comparison to be performed on the two numbers. You may choose *eq*, *ne*, *lt*, *le*, *gt*, or *ge*, representing equal, not equal, less than, less than or equal, greater than, greater than or equal.
- **value1:** the first value for the comparison

- **value2:** the second value for the comparison
- **notify:** Specifies when a new output value should be sent. Set this property to change to output a new value only when it changes from 0 to 1 or vice-versa. Set to always to send the value each time a new value arrives at the value1 or value2 input. The change setting is useful when you want to connect the output to a trigger input, so that it triggers only when the comparison result changes.

Output Properties

- **output:** the result of the comparison. For the six different comparisons, the result will be 1 when the comparison is true, 0 when it is false. Each of the comparisons is performed as follows:

eq	output is 1 if value1 equals value2, 0 otherwise
ne	output is 1 if value1 does not equal value2, 0 otherwise
lt	output is 1 if value1 is less than value2, 0 otherwise
le	output is 1 if value1 is less than or equal to value2, 0 otherwise
gt	output is 1 if value1 is greater than value2, 0 otherwise
ge	output is 1 if value1 is greater than or equal to value2, 0 otherwise

- **true:** sends a trigger whenever the output property changes from false to true (i.e., from 0 to 1).
- **false:** sends a trigger whenever the output property changes from true to false (i.e., from 1 to 0).

Compare Guarded (v1.1)

Reports when a value crosses a threshold, but prevents false triggers by using a 'guard band'.

When value goes above high, the above output will change to a 1 and the go above will send a trigger. When value goes below low, the above output will change to a 0 and the go below output will send a trigger. When value is between low and high (i.e., inside the 'guard' band'), nothing will happen.

Input Properties

- **value**: the value to be compared to the low and high value inputs
- **low:** the low value to which the value input will be compared.
- **high:** the high value to which the value input will be compared

Output Properties

- **above:** Changes from a 0 to 1 when value goes above the high input. Changes from a 1 to 0 when value goes below the low input. When value is between low and high , this output does not change.
- **go above:** sends a trigger when value goes above the high input
- **go below:** sends a trigger when value goes below the low input

Contrast Adjust (v1.1)

Adjusts the contrast of a video stream.

Typically you will only adjust the in min and in max values to control the contrast. Increase the in min value to get rid of noise in the image, decrease the in max value to increase the contrast. Changing the out min and out max values will determine the brightness of the final image – increase the out min value to make the image lighter; decrease the out max value to make the image darker.

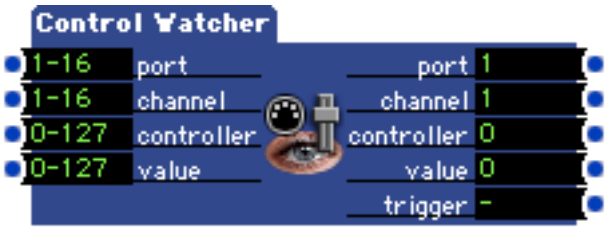
Input Properties

- **video in:** The source video stream.
- **in min**: The minimum brightness from 0 to 100% – if the brightness of the incoming video stream is below this value, it will be limited to this amount.
- **in max**: The maximum brightness from 0 to 100% – if the brightness of the incoming video stream is above this value, it will be limited to this amount.
- **out min**: The minimum brightness of the output video stream from 0 to 100%.
- **out max**: The maximum brightness of the output video stream from 0 to 100%.

Input Properties

- **video out:** The manipulated video stream.

Control Watcher



Watches for MIDI Control Change messages, outputting the values associated with that message and sending a trigger when one is seen.

The Control Watcher can look for a specific controller message or a range of messages depending on the setting of the input property values. When a message meeting all of the criterion specified by input properties is seen, the values associated with that message are sent out of the output ports and a trigger is sent out of the trigger output.

Input Properties

- **port**: Specifies the MIDI Port on which the message must arrive to be seen. These port numbers correspond to the ports shown in the MIDI Setup dialog. You may specify a single port or a range of ports.
- **channel**: Specifies the MIDI Channel on which the message must be received before it will seen by this watcher, from 1 to 16. You may specify a single port or a range of ports.
- **controller**: Specifies the controller number or range of controller numbers that will be seen, from 0 to 127.
- **value**: Specifies the controller value or range of values that will be seen, from 0 to 127.

Note that for a Control Change message to be seen by this watcher, its values must fall within the range of values for specified by all four of the input properties.

Output Properties

When this watcher sees a Control Change message that falls within the range of values specified by all of the input properties, the following values are sent out of the outputs:

- **port**: The MIDI Port on which the message arrived.
- **channel**: the message's MIDI Channel.
- **controller**: the message's controller number.
- **value**: the message's controller value.
- **trigger**: sends a trigger each time a message is seen.

Crop

Crops the foreground video stream, optionally superimposing it on a background video stream.

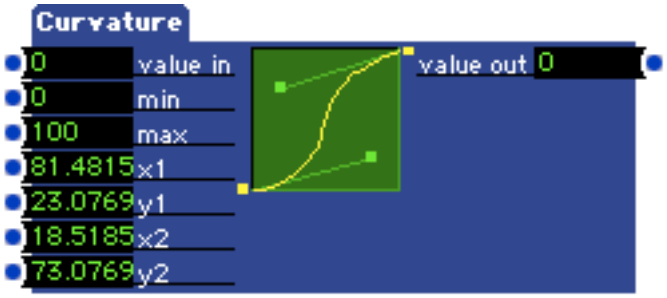
Input Properties

- **fore**: The video stream to be cropped
- **back**: The video stream on to which the cropped foreground stream will be superimposed. If no link is made to this property, the background is black.
- **left**: Specifies the inset of the crop from the left edge of the frame, expressed as a percentage from 0 to 100% of the stream's width.
- **right**: Specifies the inset of the crop from the right edge of the frame, expressed as a percentage from 0 to 100% of the stream's width.
- **top**: Specifies the inset of the crop from the top edge of the frame, expressed as a percentage from 0 to 100% of the stream's height.
- **bottom**: Specifies the inset of the crop from the bottom edge of the frame, expressed as a percentage from 0 to 100% of the stream's height.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **out**: The cropped output.

Curvature



Scales a numeric input value along a curve.

Sometimes the linear ramping provided by the Envelope Generator and other actors doesn't give just the right results because they only provide linear ramping. The Curvature actor can help you get the results you desire by scaling numeric values along a curve that you define.

NOTE that you can click on the small yellow and green boxes in the actor's icon to adjust the shape of the curve. It is probably easier to get what you're looking for this way, as opposed to typing values into the various input properties.

Input Properties

- **value in**: The value to be scaled.
- **min**: The minimum value of the scaled output.
- **max**: The maximum value of the scaled output.
- **X1**: the horizontal coordinate of the first control point.
- **Y1**: the vertical coordinate of the first control point.
- **X2**: the horizontal coordinate of the second control point.
- **Y2**: the vertical coordinate of the second control point.

Output Properties

- **value out**: The scaled value.

Deactivate Scene

Deactivates a secondary Scene previously activated by the Activate Scene actor.

See the Activate Scene actor for more information on activating secondary Scenes.

Properties

- **trigger**: when a trigger is received on this input port, the secondary Scene indicated by the mode and scene properties is deactivated.
- **scene:** indicates which Scene to deactivate. This field works in tandem with the mode field. When mode is set to *relative*, the number in this field indicates the scene to deactivate relative to the current scene. +1 would be the scene after this scene, -1 would be the scene before this scene, +2 would be the second scene after this scene, etc. When mode is set to *absolute*, the number in this field indicates a Scene in the Scene List by its position, where 1 is the first scene in the list, two is the second scene, etc.

When a valid scene has been specified in this property, its name will appear after the number.

- **mode:** determines how the number in the scene property is interpreted. When this property is set to *relative* the scene to be deactivated is relative to the position of the current scene in the Scene List. When this property is set to *absolute* the Scene to be deactivated is based on its position in the Scene List. See scene property above for more information
- **fade: (V1.1)** Specifies a fade time, over which the video and audio in the scene being deactivated will be faded out. (Note: The visual aspect of the fade in will only work if **Hardware Accelerated Rendering** is turned on in the Video tab of the Preferences.) The visual result of the fade in depends on a number of factors: what video is being rendered in the current scene, the setting of the blend and layer inputs in the Projector actors that become active, etc. See the section "Compositing with the Projector using Hardware Accelerated Rendering" on Page 144 for more information on taking advantage of multiple projectors.

Decay Generator

Generates a value that decays smoothly over time, and that can be bumped up by specified amount each time the generator is triggered.

Input Properties

- **inc trigger**: when a trigger is received on this input, adds the value given in the **inc amt** input property to the current output value.
- **inc amt**: the number that will be added to the current output value each time the **inc trig** input is triggered, ranging from 0 to 100. Note that this amount is added all at once, so the output value will jump up by this amount each time a trigger is received.
- **dec amt**: the amount by which the output value is gradually decremented every second, ranging from 0 to 100. Note that this value isn't subtracted once per second, but instead smaller amounts are subtracted at a much faster rate, resulting in a smooth change of values at the output.

Output Properties

- **value:** the decaying output value, from 0 to 100.

There are two primary ways that you might use this generator. One is generate simple ramps by setting the inc amt property to 100 and triggering the inc trig input. Each time the Decay Generator receives a trigger, the output will jump to 100 and

gradually decay to 0. The amount of time that it takes to get to 0 is determined by the dec amt property.

The other use for this generator is to generate a stream of values that stays high as when triggers are received quickly enough, but eventually decays to zero if no trigger is received for a long enough period of time. Try setting inc amt to 50 and dec amt to 33. Click the inc trig value edit box several times. As you do, you'll see the output value jump up to 100. Then stop clicking. Over a period of three seconds, the output value will gradually go down to 0. Why does it take three seconds? Because the dec amt property determines how much is subtracted from the output value every second. If you are at 100, and 33 is being subtracted every second, it will take about three seconds to reach 0.

Desaturate

Decreases the color saturation of a video stream.

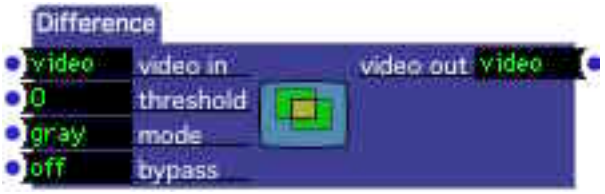
Input Properties

- **video in**: the video input stream
- **saturation**: determines the amount of color remaining in the output video stream. When this is set to 100, the actor has no effect. As this value approaches zero, the saturation of the output video stream will be reduced. When this value is 0, the output video stream is black and white.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **video out**: the desaturated video stream.

Difference



Compares the previous and current frame of the video input stream, generating a video stream that show areas that are different as a light color, and areas that are similar as dark.

Previous Frame

Current Frame

Difference

Above is an example. In the previous and current frames of video, the hand has moved just slightly to the right. The brightest part of the resulting difference is the edges, that is, where the image is most different. Parts that are similar (the palm for instance) are darker.

Input Properties

- **video in**: the video input stream
- **threshold**: determines how different the previous and current frames must be before you will see something in the video output stream. When set to higher values, the difference between the two frames must be more profound before a color will be appear in the video output stream.

  Setting this property to higher values is useful to get rid of video "noise" (seen as stray pixels at the output) that can be seen when the video input stream was shot at low light levels.
- **mode:** When set to gray, the difference output is based on the overall brightness of the current and previous video frames. In this mode, the output is shades of gray. When set to color, the difference is calculated on the individual red, green, and blue components that make up the video image. In this mode, the output will be in color.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

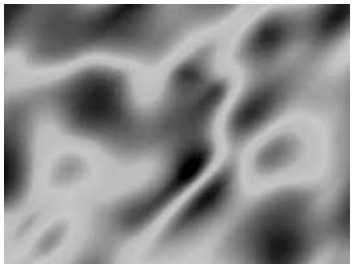
- **video out**: the difference between the current and previous frames of video.

Displace

Offsets the pixels of a video stream based on the brightness of a second video stream.

Displace "warps" the source video stream by shifting its pixels around by using the brightness of the displaced video stream to determine how far to move the pixels. For example, assuming the displace angle is zero, when the displace video is gray (i.e., 50% brightness) the pixels of the source are not moved at all; as it approaches black the source video pixels are shifted more to the left; as it approaches white, the source video pixels are shifted more to the right.

Source Video



Displace Video

Displaced Video

Input Properties

- **source**: The video input stream
- **displace**: Video stream whose brightness determines how far to shift the pixels of the source video.
- **amount:** The strength of the displace effect, from 0 to 100%. The higher the value, the more profoundly the pixels of the source video will be shifted.
- **displace angle:** Sets the angle of the line along which the pixels are shifted.
- **offset:** How far to offset the resulting image, from 0 to 100%. If the displace video stream is too bright or too dark, the resulting video may go off the edge of the stage. Adjust this value to bring the image back into view again.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

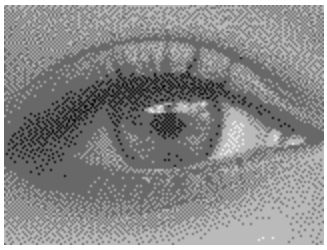
- **video out:** The resulting displaced video output.

Dither

Dithers the incoming video stream by copying to an intermediary buffer with a lower resolution and/or bit depth.

Original

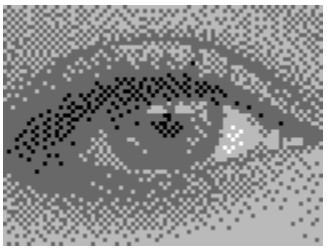
Colors = 2 – Res. = 100

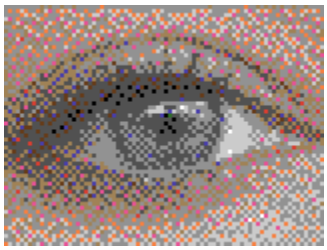

Colors = 4 – Res. = 100

Colors = 16 – Res. = 100

Colors = 256 – Res. = 100

Colors = 2 – Res. = 50


Colors = 4 – Res. = 50


Colors = 16 – Res. = 50

Colors = 256 – Res. = 50

Input Properties

- **video in**: the video input stream

  resolution: specifies the resolution of the intermediary buffer, from 0 to 100% of the incoming video stream's size. Lower values will pixilate the image more.
- **color:** Specifies the number of colors in the intermediary buffer. Possible values are 2, 4, 16, 256, and Thousands.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

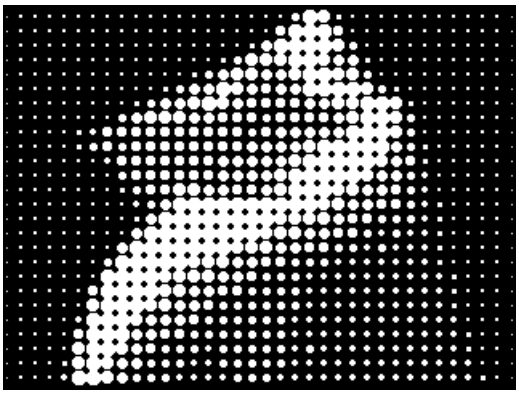
Output Properties

- **video out**: the dithered video output.

Dots

Makes a video stream look like a “screened” image in a newspaper, consisting of dots whose size varies depending on the brightness of the source image.

video in



size = 4, mode = dots, color = off

video in

size = 4, mode = boxes, color = on

Input Properties

- **rgb in**: The video input stream. If this stream is YUV, it will be automatically converted to RGB.
- **dot size**: The size of the dots or boxes.
- **mode:** Either dots or boxes. When set to dots, the screen is circular. When set to boxes, the screen is rectangular.
- **color:** When turned off, the output video stream is black and white. When turned on, the color of the video input stream is preserved.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **rgb out:** The resulting video output in RGB format.

Effect Mixer

Combines two video streams using various mathematical operations.

The operations available are:

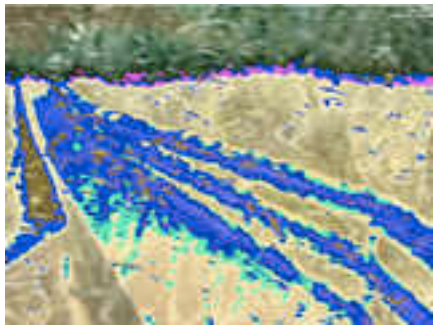
- **addovr - add with overflow**. Adds the colors of both streams together without limiting the result.
- **addmax – add with limit maximum**. Adds the colors of both streams together, limiting the sum to 255.
- **subovr – subtract with overflow**. Subtracts the colors of the second stream from the first without limiting the result.
- **submin – subtract with limit minimum**. Subtracts the colors of the second stream from the first, limiting the minimum result to zero.
- **xor – logical exclusive or**. Performs an *exclusive or* operation on both streams.
- **and – logical and.** Performs an *and* operation on both streams.
- **or – logical or**. Performs an *or* operation on both streams.
- **mult – multiply**. **(V1.1)** Multiplies corresponding pixels of both streams and outputs the result.
- **min – minimum**. **(V1.1)** Compares corresponding pixels from both streams, and outputs the lesser of the two
- **max – maximum**. **(V1.1)** Compares corresponding pixels from both streams, and outputs the greater of the two.

- **diff – difference. (V1.1)** Subtracts corresponding pixels from both streams and outputs the difference between the two.

Below you will see some examples of the operations possible. Depending on the source material, the result can range from impressionistic to psychedelic. Experimentation is the key to generating interesting images with this actor.

video in 1

video in 2

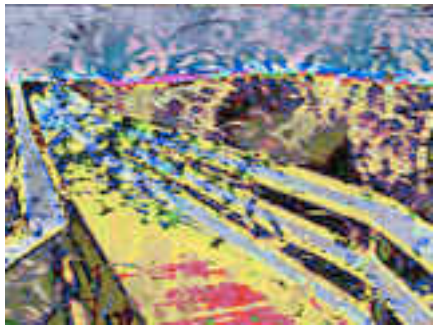


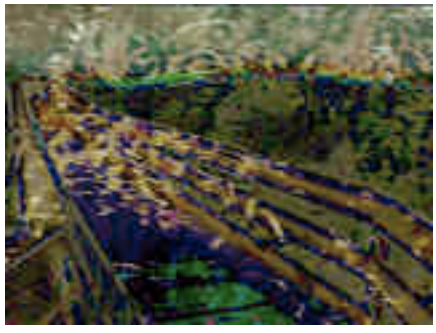
addovr

addmax

subovr

submin





xor and

or

Input Properties

- **rgb in 1**: The first video input stream. If this stream is YUV, it will automatically be converted to RGB.
- **rgb in 2**: The first second input stream. If this stream is YUV, it will automatically be converted to RGB.
- **mode:** One of addovr, addmax, subovr, submin, xor, or, mult, min, max, or delta. More details of these operations are given above.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **rgb out:** The combined video output in RGB format.

Enter Scene Trigger

Sends a trigger when this actor's Scene is activated.

This actor is useful when you need to tell another actor to do something as soon as its Scene is activated.

Properties

- **trigger:** Sends a trigger as soon as this actor's Scene is activated.

Enter Scene Value

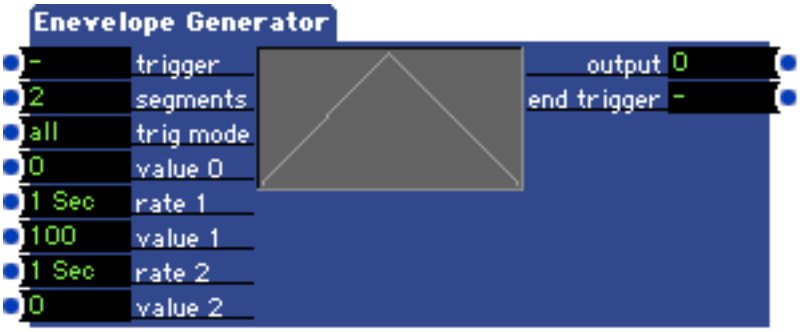
Sends a value when this actor's Scene is activated.

This actor is useful when you need to preset the input property value of another actor when its Scene is activated.

Properties

- **value:** The value to be sent when this actor's Scene is activated.
- **output:** Outputs the value specified by the value input property when this actor's Scene is activated.

Envelope Generator



Generates values that ramp from one point to another over time.

The envelope generator is useful in situations where you need a value that ramps from a starting point to an ending point over a specific amount of time. Because you can have up to nine segments in the ramp, each with their own starting value, ending value, and rate, you can create envelopes that are fairly complex.

Input Properties

- **trigger**: When trig mode is set to all, triggers starts ramping the envelope from the beginning. When trig mode is set to ind/one, starts ramping the next segment of the envelope. (See trig mode) for more info.
- **segments:** Specifies how many segments are in the envelope, from 1 to 9. This number determines how many pairs of rate and level input properties will be found along the left edge of the actor.
- **trig mode**: specifies what will happen when a trigger is received at the trigger input, and when triggers will be sent out of the end trigger output.

When this property is set to all and a trigger is received, the envelope starts ramping from the first segment each time a trigger is received and continues until the last segment is complete. At the completion of the last segment, a trigger is sent out of the end trigger output.

When set to ind/one or ind/end, each trigger ramps the next segment of the envelope. If no segments have been triggered yet, or if all the segments have been triggered, then the ramping begins at the first segment. The difference between ind/one and ind/end has to do with the end trigger output. When set to ind/one, a trigger is sent out of the end trigger output at the end of each segment. When set to ind/end the end trigger output is triggered at the completion of the last segment.

- **level 0**: the starting value for the first segment.
- **rate 1, rate 2, etc**.: Determines the number of seconds that it takes to get from the previous level to the next level. E.g., rate 1 specifies how long it takes to get from level 0 to level 1.
- **value 1, value 2, etc.**: The value at that point in the envelope, between 0 and 100. Together with the rate between them, a pair of subsequent levels (e.g., level 1, rate 2, level 2) defines a ramp segment.

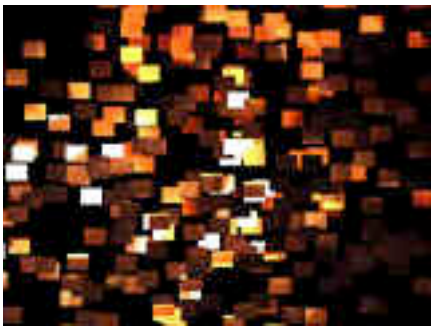
Output Properties

- **value**: The value of the envelope as it moves through the segments, between 0 and 100.
- **end trigger**: sends a trigger at the end of the entire envelope, or at the end of a segment depending on the setting of the trig mode property. (See trig mode above for more information.)

Explode (v1.1)

"Explodes" a video stream by breaking the source image into a series of rectangles and shifting their position.

Before



After

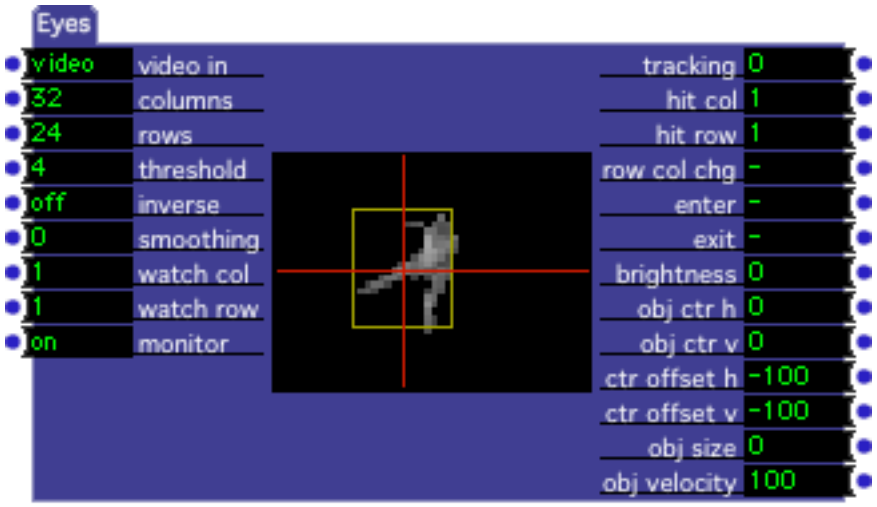
Input Properties

- **video in**: The video input stream.
- **amount**: Determines how “exploded” the image will be –!higher numbers spread the rectangles further from their original location.
- **distance**: Specifies the maximum distance the rectangles will travel from their original location.
- **horiz size**: The horizontal size of the rectangles, from 0 to 100% of the width of the incoming video stream.
- **vert size**: The vertical size of the rectangles, from 0 to 100% of the height of the incoming video stream.
- **erase**: When this is turned on, the background is erased before the rectangles are drawn. When this is turned off, the background is not erased, leaving “trails” as you move the rectangles using the amount input.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **video out**: The exploded image.

Eyes



Tracks the position of an object in a video stream based on its brightness.

The Eyes actor will report the location of the brightest object in the video stream, based on its location in a grid superimposed upon that video stream. It will also report the size of the object, and its velocity (i.e., speed of movement.)

The rows and columns inputs determine the size of a grid. As each frame arrives, Eyes analyzes the image looking for the grid coordinate that is brighter than all the others. It then reports the position of that object.

To help you configure the Eyes inputs, turn on the monitor input. When you do, a miniature monitor window will appear in the center of the actor. The red crosshairs show the center of the object, and the yellow rectangle shows the "bounding box" of the object as it is tracked.

Because displaying the monitor consumes some of your CPU speed, you should turn it off once you have configured eyes to your satisfaction.

You may optionally set a grid location to be watched using the watch col and watch row properties. When an object enters this grid location, the enter output will send a trigger; when the object disappears, the exit output sends a trigger.

Generally speaking, the higher contrast the incoming video image, the easier it will be for Eyes to track – placing a performer in a light colored costume on a black background is ideal. You can also improve tracking by filtering the video before you attempt to track it. The two actors that can be quite useful in this respect are Difference and Chroma Key.

If you connect the output of the Difference actor to Eyes' video input, you can track the location of an object that is moving in the frame, even in poor lighting conditions. You can track a colored object by using the setting the Chroma Key's key color to the color of the object you want to track, and feeding its output to the video input of Eyes.

Input Properties

- **video**: The source video input to be analyzed.
- **columns** and **rows**: Specifies the number of columns and rows in the grid used to determine the object's location. Higher numbers give finer resolution, but this does not necessarily mean that Eyes will track more accurately. Experimentation is the key to finding the right values for these inputs.
- **threshold**: The brightness threshold. An object's brightness must be above this value for Eyes to 'see' it. If the monitor is on, and the brightness is below this value, that gird point will be drawn as black.
- **inverse:** Turn this property on to track the darkest point in the frame, instead of the brightest.
- **smoothing:** When this property is greater than zero, the values sent out of the obj ctr h, obj ctr v,obj size and velocity outputs will be "smoothed", reducing the amount of jitter as the object is tracked. Higher values smooth the outputs more. Be cautious of setting this value too high, as the object center outputs will begin to lag behind the object being tracked by a noticeable amount.
- **watch col** and **watch row**: Specifies a specific grid location that will be watched. When an object enters this location, the enter output will send a trigger. When an object leaves this location, the exit output will send a trigger.
- **monitor**: Turn this property on to see a monitor window inside the actor. This will show you what the Eyes actor is seeing – this will help you to adjust the threshold input. The red crosshairs show the center of the object, and the yellow rectangle shows the "bounding box" of the object as it is tracked.

  Because displaying the monitor consumes some of your CPU speed, you should turn it off once you have configured eyes to your satisfaction.

Output Properties

- **tracking**: Outputs a 1 when an object is being tracked. Otherwise, it outputs a 0.
- **hit col**: Reports grid column within which the last object was seen.
- **hit row**: Reports grid row within which the last object was seen.
- **row /col chg**: Sends a trigger whenever the grid row or grid column changes.
- **enter**: Sends a trigger whenever an object appears in the grid row and column specified by the watch row and watch col inputs.
- **exit**: Sends a trigger whenever an object disappears from the grid row and column specified by the watch row and watch col inputs.
- **brightness**: reports the overall brightness of the incoming video stream. A completely black frame gives a value of 0, a completely white frame gives 100. This input can be quite useful if you connect the Difference actor to the input, as the more motion there is in the incoming video input the higher the output value will be.
- **obj ctr h** and **obj ctr v**: Reports the center of the bounding box of the object being tracked, from 0 to 100% of the frame width/height of the video frame. If the

smoothing input is set to a value greater than zero, this output will be smoothed as it tracks the object, reducing the amount of jitter in this output.

- **ctr offset h** and **ctr offset v**: Reports the offset from obj ctr h and obj ctr v of the centroid of the object being tracked, as calculated by its brightness, from 0 to 100% of the frame width/height of the video frame. If the smoothing input is set to a value greater than zero, this output will be smoothed as it tracks the object, reducing the amount of jitter in this output.
- **obj size:** Reports the size of the object, relative to the size of the video frame, from 0 to 100%. This value is essentially the ratio of the area of the bounding box to the area of the video frame.
- **velocity:** Reports the velocity of the object being tracked. The faster the object moves, the higher this value.

Filter

Smoothes a jittery stream of values.

NOTE: This actor has been superceded by the Smoother actor. If you need to smooth out a stream of numbers, the Smother actor is now the recommended choice.

Sometimes you have a source of values where the numbers jump up and down. This actor uses a weighted averaging of the past values to provide a smoother version of the input value stream.

The key settings to adjust when attempting to smooth your values are the stages and decay input properties. The number of stages determines how many of the previous numbers the filter remembers. The decay determines how much influence those remembered numbers have on the current value. For instance, decay is set to one second, numbers that are 1/2 second old would have half the influence of a number that just arrived. Numbers older than one second would have no influence at all.

The frequency output determines how often a new output value is calculated. Higher values here produce a smoother output.

Input Properties

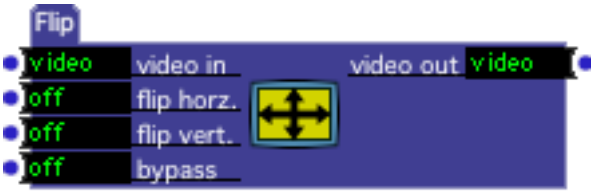
- **value**: The stream of incoming values
- **frequency**: The frequency with which new values will appear at the output

- **stages**: How many of the previous values will be remembered by the filter as it calculates the new value
- **decay**: How long a value's influence to decay to 0.
- **scaling**: Multiplies the output value by this number to provide a better range of output values.

Output Properties

- **output**: The smoothed values.

Flip



Flips a video stream horizontally, vertically, or both.

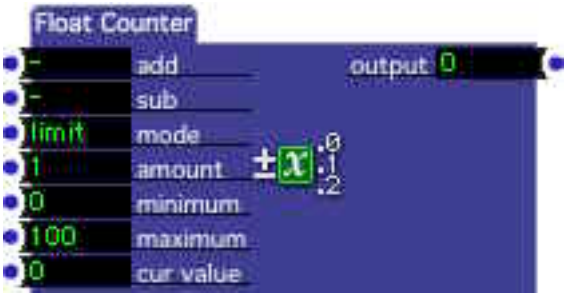
Input Properties

- **video in**: The video input stream
- **flip horz.**: When turned on, flips the video image horizontally
- **flip vert.**: When turned on, flips the video image vertically
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **video out**: The flipped video output stream.

Float Counter



Counts up or down when a trigger is received.

The Float Counter (and its companion, Integer Counter) allows you to count up or down each time a trigger is received by adding or subtracting a value to/from its output value. You have the option of limiting the output value to a range of values, or to let that value "wrap around" when it exceeds those limits. This actor allows floating-point numbers (i.e., values with numbers after the decimal point), while the Integer Counter uses integer numbers.

Input Properties

- **add**: Adds the value specified by the amount input property to the current value at the output. The resulting value is limited by the minimum and **maximum** properties.
- **subtract**: Subtracts the value specified by the amount input property to the current value at the output. The resulting value is limited by the minimum and maximum properties.
- **mode**: Determines how to constrain the output value when it exceeds minimum or maximum. When set to limit, and an addition or subtraction is made to the output value that would exceed minimum or maximum, the output value is limited to these values. When set to wrap and the calculated value is less than minimum or is greater than maximum, it "wraps around" to other extreme.

  For example, if the maximum is 100, the current output value is 95, and you trigger the add input while the amount property is set to 10.5, the new value would be 105.5. Since this would exceed the maximum (100) the float counter subtracts the maximum value from the result and sets the output to the resulting value of 5.5.
- **amount**: The amount to add or subtract the counter receives a trigger on the add or subtract trigger input.
- **minimum**: The minimum possible value. See mode for more information on how this value is used.
- **maximum**: The maximum possible value. See mode for more information on how this value is used.
- **cur value**: This is the value to which the 'amount' property is added to or subtracted from when calculating the output. It is an unusual input, in that it is automatically set to match the output value each time the 'add' or 'subtract' trigger inputs are pulsed. You can make use this property in two ways: first, you can click it's title, check the **Init** checkbox, and specify an initial value from which the counter will begin counting; second, you can send a value to it to preload the next value that will be added to or subtracted from.

Output Properties

- **output**: The current output value of the counter.

Freeze

Freezes a video input stream by grabbing the current frame when triggered.

Input Properties

- **video in**: The video input stream.
- **freeze**: When turned off, the video input passes directly to the output. When turned on, the video output will freeze.
- **grab**: When triggered, grabs the video current frame of video, and sends that single frame of video to the frozen video output.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **video out**: The frozen video output stream.

Gate

Allows or prevents values from passing from the input to the output.

When the gate input property is set to on, any value sent to the input will be sent on to the output. When the gate property is set to off, values arriving at the input are blocked and not passed to the output.

Note that the in input and out output of this actor are mutable. This means they will *all* change their type (integer, float, video, etc.) to match the first link made to either of these properties. Once a link has been made to any of the mutable properties, their types will remain fixed, based on that first connection, until all have been disconnected. Then the properties become mutable again.

Input Properties

- **in:** Values that will be echoed to the output when the gate property is on.

- **gate:** When the gate property is on, any value sent to the input will be echoed at the output. When the gate property is off, values arriving at the input are blocked and not passed to the output.

Output Properties

- **out:** Echoes all values sent to the in input as long as the gate property is on.

Gaussian Blur

Performs a Gaussian blur on a video stream.

Input Properties

- **rgb in**: The video input stream.If this stream is YUV, it will automatically be converted to RGB.
- **size**: The diameter of the blur mask. The larger this value, the blurrier the resulting image.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **rgb out**: The blurred video output stream in RGB format.

Get Media Count

Returns the number of media objects within a specified bin.

Input Properties

- **type**: The media type of the bin whose objects will be counted. Can be video, audio, midi, picture, or 3D.
- **bin**: The index of the bin whose objects will be counted. For example, if the type input is set to audio, and the bin input is set to 3, then the output would be the count of the audio files in the third audio bin.

Output Properties

- **count**: The number of media objects within the specified bin. If the bin doesn't exist, the output is zero.

Get Media Index (v1.1)

Returns the media index of a media object within a specified bin.

For example, if the type input is set to audio, the bin input is set to 3, and the item input is set to 5, then the output would be the media index of the fifth audio file within the third audio bin. The output value could then be passed a Sound Player actor to play the specified sound.

Input Properties

- **type**: The media type of the bin whose objects will be counted. Can be video, audio, midi, picture, or 3D.
- **bin**: The index of the bin within which the media object is located.
- **item**: The index of the bin within the specified bin.

Output Properties

- **count**: The absolute index of the specified media object, which can be passed to an appropriate player actor to play the specified media. If no media object can be found within the specified bin, the output value will be 0.

Hold Range

Outputs the minimum and maximum value ever received on any input, and the range between the two.

Input Properties

- **reset**: Resets the min, max and range outputs.
- **inputs**: Sets the number of value inputs, from 1 to 16.

- **value 1, value 2, etc.:** Whenever a value is received at any value input, it is compared to the current minimum and maximum values. If it is less than minimum or greater than maximum, the corresponding output is set and the range output is updated to reflect the new range between minimum and maximum.

Output Properties

- **min**: The minimum value ever received on any of the value inputs.
- **max**: The maximum value ever received on any of the value inputs.
- **range**: The range between minimum and maximum, i.e., maximum - minimum.

HSL Adjust

Manipulates the hue, saturation and luminance (brightness) of a video stream.

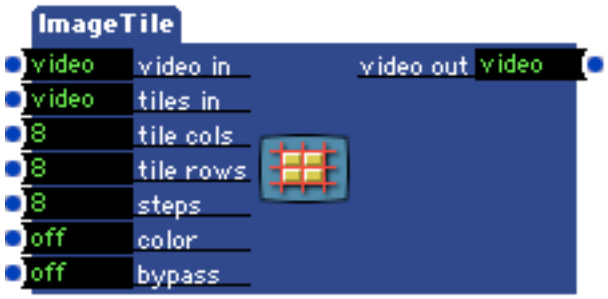
Input Properties

- **rgb in**: The input video stream. If this stream is YUV, it will automatically be converted to RGB.
- **hue offset**: How much to offset the hue, from –360 to +360 degrees.
- **saturation**: How much to change the saturation, from 0 to 200%. A value of 100 introduces no change. Values below 100 make the image less saturated, values above 100 make in more saturated.
- **Luminance:** How much to change the luminance (brightness), from 0 to 200%. A value of 100 introduces no change. Values below 100 make the image darker; values above 100 make the image brighter.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **video out**: The colorized video stream in RGB format.

Image Tile



Displays the incoming video stream in the form of 'tiles' of varying brightness that are created by from a second video stream.

Whenever a new frame of video arrives at the 'tiles in' input, it is broken into a series of tiles whose height and width are specified by the tile cols and tile rows inputs. Then, the brightness of each tile is analyzed and stored. When a new frame of video arrives at the video in input, it is reconstituted by creating a mosaic of tiles of the appropriate brightness.

For instance, consider the following tiles in input

which is the ASCII character set. Each character occupies 6 pixels across, and 8 pixels down. Because there are 67 characters across, the total size of this image is 67 x 6 = 402 pixels across by 8 pixels down.

Using the Picture Player to supply this image as an input to the tiles in input, you would set tile cols to 67 and the tile rows to 1. Upon receiving this input, the Image Tile actor would analyze the each tile, determining its brightness.

Finally, as frames of video arrive at the video in input, they would be broken down into tiles of matching size (6 across, 8 down). Each of the tiles in the video in stream is replaced by the tile from the tile in input whose brightness most closely matches the original.

Using the ASCII character set example above, note the transformation of the image. (Because the image is small, you may need to blur your eyes a bit to appreciate the result – higher resolution images look better.)

before

after

While this example was made using a still image, you can just as easily supply a moving video to the tiles in input. The results in this case depend greatly on the content of that video stream, but it can lead to interesting effects.

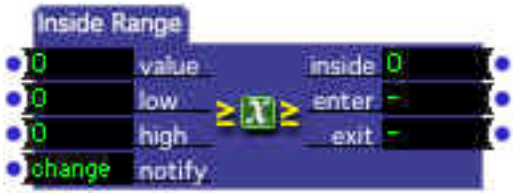
Input Properties

- **video in**: The video input stream to be tiled.
- **tiles in**: The video input that will be used to create the tiles. The height and width of each tile are given by the 'tile cols' and 'tile rows' inputs.
- **tiles across**: The number of tiles across in the 'tile in' video stream.
- **tiles down**: The number of tiles down in the 'tile in' video stream.
- **steps**: The number of brightness steps to use when creating the final image. Lower numbers produce a coarser resolution of brightness, higher numbers give finer resolution.
- **color**: "When off, the color of the tiles used to create the final output is the same as received at the 'tile in' input. When on, imposes the color of the source image on the tiles. Turning this setting on may produce unusual colorization effects when the 'tile in' image is not black and white.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **video out**: The tiled video output stream.

Inside Range (v1.1)



Reports whether or not a value is within a specified range.

Input Properties

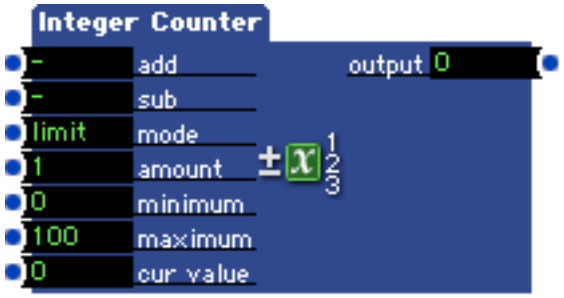
- **value**: The value to be compared to the range specified by the low and high input properties.
- **low**: The low value of the range to which the input value will be compared.
- **high**: The high value of the range to which the input value will be compared.
- **notify:** Specifies when a new output value should be sent to the inside output. Set this property to change to output a new value only when inside changes from 0 to

1 or vice-versa. Set to always to send the value each time a new value arrives at the value input.

Output Properties

- **inside**: Outputs a 1 when value is within the range specified by low and high. Outputs a 0 otherwise.
- **enter**: Sends a trigger when the last value received at the value input was outside the range specified by low and high, and the new value is inside this range.
- **exit**: Sends a trigger when the last value received at the value input was inside the range specified by low and high, and the new value is outside this range.

Integer Counter



Counts up or down when a trigger is received.

The Integer Counter (and its companion, Float Counter) allows you to count up or down each time a trigger is received by adding or subtracting a value to/from its output value. You have the option of limiting the output value to a range of values, or to let that value "wrap around" when it exceeds those limits. This actor uses integer numbers (i.e., values with no numbers after the decimal point), while the Float Counter uses floating-point numbers.

Input Properties

- **add**: Adds the value specified by the amount input property to the current value at the output. The resulting value is limited by the minimum and maximum properties.
- **subtract**: Subtracts the value specified by the amount input property from the current value at the output. The resulting value is limited by the minimum and maximum properties.
- **mode**: Determines how to constrain the output value when it exceeds minimum or maximum. When set to limit, and an addition or subtraction is made to the output value that would exceed minimum or maximum, the output value is limited to these values. When set to wrap and the calculated value is less than minimum or is greater than maximum, it "wraps around" to other extreme.

For example, if the maximum is 100, the current output value is 85, and you trigger the add input while the amount property is set to 27, the new value would be 112. Since this would exceed the maximum (100) the float counter subtracts the maximum value from the result and sets the output to the resulting value of 12.

- **amount**: The amount to add or subtract the counter receives a trigger on the add or subtract trigger input.
- **minimum**: The minimum possible value, which can be set to any integer value. See mode for more information on how this value is used.
- **maximum**: The maximum possible value, which can be set to any integer value. See mode for more information on how this value is used.
- **cur value**: This is the value to which the 'amount' property is added to or subtracted from when calculating the output. It is an unusual input, in that it is automatically set to match the output value each whenever the 'add' or 'subtract' trigger inputs are pulsed. You can make use this property in two ways: first, you can click it's title, check the **Init** checkbox, and specify an initial value from which the counter will begin counting; second, you can send a value to it to preload the next value that will be added to or subtracted from.

Output Properties

- **output**: The current output value of the counter.

Interlacer

Interlaces two video images by alternating copying rows from the two incoming video streams.

Example input and output, with height and spacing parameters set to 5%

video 1

video 2

output

Example output, with no input connected to video 2, height set to 1.1 and spacing set to 0.8

output

Input Properties

- **video 1**: A video stream to be interlaced with the stream arriving at the 'video 2' input. If no vide stream is linked to 'video 2', this stream will be interlaced with black.
- **video 2**: A video stream to be interlaced with the stream arriving at the 'video 1' input.. If this input is left disconnected, black is used for the background.
- **height**: The height of each row copied from the 'video 1' input, expressed as a percentage of the stream's height.
- **spacing**: The space between each row copied from the 'video 1' input, expressed as a percentage of the stream's height. This space is filled with the image appearing at the 'video 2' input, or black if no input is specified.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **output**: The interlaced video output stream.

Jump

Activates a new Scene after deactivating the current primary Scene.

The jump actor allows you to move from one scene to another. When a trigger is received on the trigger input, the all of the actors in the current Scene are deactivated, and then all of the actors in the new Scene are activated.

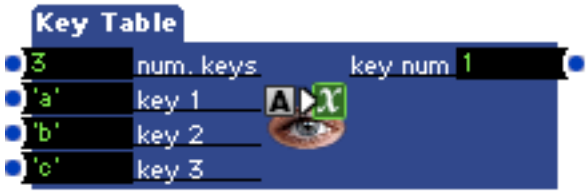
Properties

- **trigger**: when a trigger is received on this input port, the primary Scene indicated by the mode and scene properties is activated.
- **scene:** indicates which Scene to activate. This field works in tandem with the mode field. When mode is set to *relative*, the number in this field indicates the scene to activate relative to the current scene. +1 would be the scene after this scene, -1 would be the scene before this scene, +2 would be the second scene after this scene, etc. When mode is set to *absolute*, the number in this field indicates a Scene in the Scene List by its position, where 1 is the first scene in the list, two is the second scene, etc.

  When a valid scene has been specified in this property, its name will appear after the number.

- **mode:** determines how the number in the scene property is interpreted. When this property is set to *relative* the scene to be activated is relative to the position of the current scene in the Scene List. When this property is set to *absolute* the Scene to be activated is based on its position in the Scene List. See scene property above for more information.
- **xfade: (V1.1)** Specifies an optional visual and aural crossfade between the current scene and the scene that is the target of the jump. (Note: The visual aspect of the fade in will only work if **Hardware Accelerated Rendering** is turned on in the Video tab of the Preferences.) The visual result of the fade in depends on a number of factors: what video is being rendered in the current scene, the setting of the blend and layer inputs in the Projector actors that become active, etc. See the section "Compositing with the Projector using Hardware Accelerated Rendering" on Page 144 for more information on taking advantage of multiple projectors.

Key Table Watcher



Generates a number identifying which key on the computer keyboard, of a specific set, was pressed.

The Key Table is useful when you want a set of keys on the keyboard to control another actor. You specify the number of keys for which you want to look, and then enter the keys into the watcher. When one of those keys is pressed, Key Table outputs a value indicating the position of that key in the list.

Input Properties

- **num keys**: Determines the number of keys that this watcher will see, from 1 to 32. Note that when you set this property, the Limit Min and Limit Max settings of the key num output property will be reset to 1 and the value you just entered.
- **key 1, key 2, etc.**: The list of keys that this watcher will see. When typing a key into this value edit box, you should enclose it in single quotes (‘), e.g., the letter B is entered as ‘B’.

Output Properties

- **key num**: When a key is pressed on the computer keyboard that matches one of the keys given in key 1, key 2, etc., outputs the position of that key in the list, starting with 1 for the first key, 2 for the second, etc.

Keyboard Watcher

Watches for a key or range of keys on the computer keyboard to be pressed, released or both.

With the Keyboard Watcher you can specify a single key or range of keys that the watcher will see. When the watcher sees one of those keys, and it is going in the direction specified by the direction input, it will send that character associated with that key the output.

Input Properties

- **key range**: Specifies the key or range of keys that the watcher will see. Specify a single key by typing it into this value edit box enclosed by single quotes (‘), e.g., the capital letter B is entered as ‘B’. To specify a range of keys, type two keys separated by a hyphen, e.g., ‘A’-‘Z’.

  Note that the key range is *case sensitive* in that the keys Z and z are considered to be different.

- **direction**: Determines whether the watcher will see keys that are pressed (down), released (up), or both.

Output Properties

- **key**: When a key is pressed on the computer keyboard that matches the key or range of keys specified in key range input, and it is traveling in a direction that matches the direction input, that character associated with that key is sent out of this output

  Remember that you can link the output of the key watcher to the input of a trigger, if you would simply like to trigger an event when the user presses a key.

LanBox Channels (v1.1)

Allows Isadora to control a LanBox LC connected to your computer via a local area network (i.e., Ethernet) connection.

The LanBox Channels actor allows you to set the level of a contiguous range of DMX channels on a LanBox LC lighting control unit. The meaning of some of the parameters are specific to the LanBox LC – please refer to the manual for more details.

Input Properties

- **udp addr**: Specifies the UDP address to which the messages will be sent. This should match the UDP address specified for your LanBox in the LCEdit program.
- **udp port**: Specifies the UDP port number to which the messages will be sent. This should match the UDP address specified for your LanBox in the LCEdit program.
- **msg type**: can be set to either write or publish. publish equates to the **buffer broadcast** command (hex C9), write equates to the **buffer write** command (hex CA). For more detailed information, please refer to the UDP documentation for the LanBox
- **buffer id**: specifies the LanBox buffer to which the channel data will be written.

  When msg type is set to publish, you can use the following values

  252 = DMX Input Buffer
  253 = Analog/Switch Inputs
  254 = Mixer Buffer
  255 = DMX Output Buffer

  When msg type is set to write you may specify a value of 1-64 to write directly into the LanBox's Layer Buffers (A through BK) or 254 to write directly into the Mixer Buffer.
- **chan offset**: determines the actual channels to be transmitted – essentially this number plus one. For example, when chan offset is set to 0, the dmx 1 input would send to channel 1, dmx 2 would send to channel 2, and so on. If the chan offset is 50, then dmx 1 would send to channel 51, dmx 2 to channel 52, etc.
- **channels**: determines the number of dmx channel inputs. Increasing this number will add more dmx n inputs, decreasing this number will remove them.
- **dmx 1, dmx 2, …** : Use these inputs to specify the DMX values for each channel. (The number of available inputs is specified by the channels input property.) The actual channel number is depends on the setting of the chan offset input. If the chan offset is 50, then then dmx 1 would control channel 51.

LanBox RGB Out (v1.1)

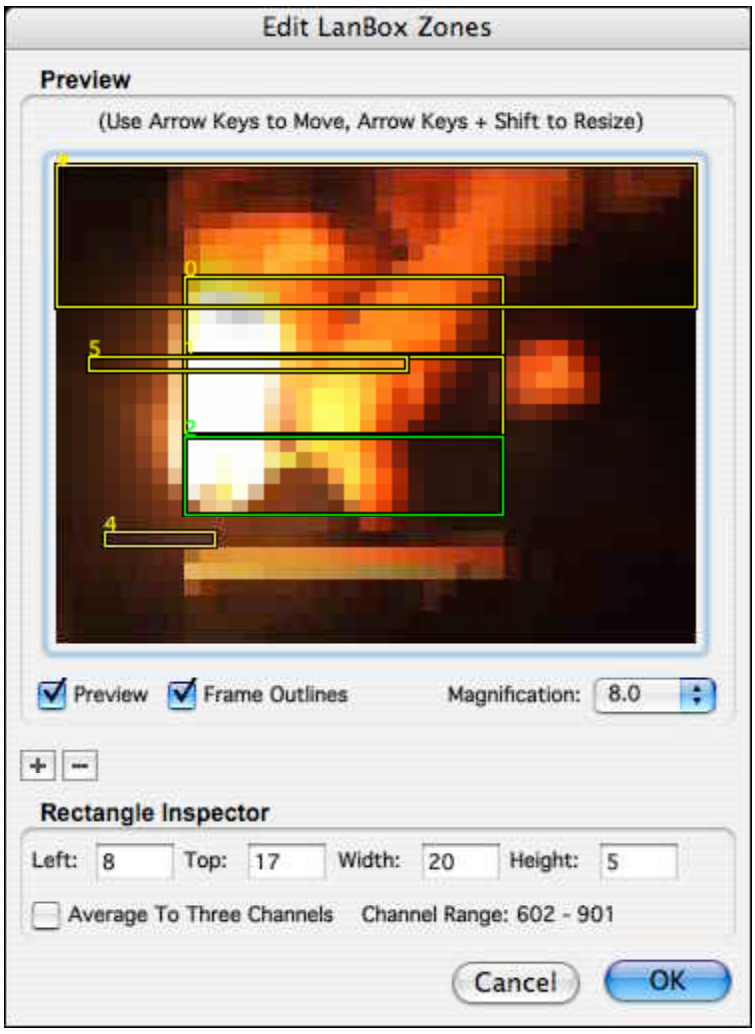
Allows you to map the colors of a video stream to channels of a LanBox LC.

The LanBox RGB Out actor is specially designed to take advantage of lighting instruments that can be produce RGB colors. This actor will map the color of specific areas within an incoming video stream to channels on a LanBox LC, allowing the colors of the video to control the color of the lighting. For each analyzed pixel, three channels will be sent to the LanBox, the first representing the red component of the pixel, the second the green component, and the third the blue component.

To use this actor, you must first specify which areas within the video stream will be analyzed and transmitted to the LanBox LC. To do this, begin by connecting a video stream to the video input of the LanBox RGB Out actor. It is a good idea to use a relatively low-resolution video –!use the Scaler actor to reduce the size of the video clip if necessary.

It is very important that you establish the resolution of the video input for this actor before you start setting the position of the rectangles. Unlike most of Isadora, the position of the rectangles is specified using absolute pixels –!not a percentage. So, if you specify the rectangle positions, and then change video resolution, you will most likely have to edit the rectangle sizes and locations again.

To edit the rectangles, double-click the LanBox RGB Actor. The following dialog will be shown.



To add a rectangle, click the "+" button

To remove a rectangle, click the "-" button

To select a rectangle, and show its inspector, click on the rectangle's outline. A rectangle is green when it is selected, otherwise it is yellow.

After adding a new rectangle, or selecting an existing one, the "Rectangle Inspector" will appear at the bottom of the dialog. This allows you to adjust the size and position of the rectangle numerically. You can also move the currently selected rectangle using the arrow keys, or resize it by using the arrow keys while simultaneously holding down the shift key.

Note that, when a rectangle is selected, the DMX channels that will be sent to the LanBox are shown to the right of the Channel Range prompt at the bottom right of the inspector. The base channel is determined by the setting of the chan offset input property of the LanBox RGB Out actor. The total number of channels to be transmitted from a particular rectangle will equal the width times the height times 3 (W x H x 3). So, a 4 x 3 rectangle will send 36 channels total.

For example, let's say we have two rectangles –!one that is 4 x 3 pixels (36 channels total), another that is 10 x 1 (30 channels total), and that the chan offset input of the actor is set to 50. The first rectangle will broadcast its RGB values to LanBox channels 51-86. The second rectangle would broadcast to LanBox channels 87-116.

You may also choose average all of the pixels under a rectangle down to three channels (i.e., a single RGB value). To do this, check the "Average to Three Channels" check box when a rectangle is selected.

You can change the magnification of the image within the dialog box using the "Magnfication" popup. You may also turn off the video preview by unchecking the "Preview" checkbox.

Once you have set up all of the rectangles click the OK button to store the new settings, or click Cancel to exit the dialog without saving the edited rectangles.

Input Properties

- **video in**: receives the video stream to be analyzed.
- **udp addr**: Specifies the UDP address to which the messages will be sent. This should match the UDP address specified for your LanBox in the LCEdit program.
- **udp port**: Specifies the UDP port number to which the messages will be sent. This should match the UDP address specified for your LanBox in the LCEdit program.
- **msg type**: can be set to either write or publish. publish equates to the **buffer broadcast** command (hex C9), write equates to the **buffer write** command (hex CA). For more detailed information, please refer to the UDP documentation for the LanBox
- **buffer id**: specifies the LanBox buffer to which the channel data will be written.

  When msg type is set to publish, you can use the following values

  252 = DMX Input Buffer
  253 = Analog/Switch Inputs
  254 = Mixer Buffer
  255 = DMX Output Buffer

  When msg type is set to write you may specify a value of 1-64 to write directly into the LanBox's Layer Buffers (A through BK) or 254 to write directly into the Mixer Buffer.
- **chan offset**: determines the actual channels to be transmitted. See the explanation of the rectangle editor above to understand how the chan offset is used when sending information to the LanBox LC.

Limit-Scale Value

Limits the incoming value to a specified range, and then scales the output to a different range.

The Limit-Scale Value actor performs the two actions implied by its name. First, it limits the incoming value to the range specified by the limit min and limit max inputs. It then scales the limited value to the range specified by the out min and out max inputs.

This actor can be especially useful when you have a value that does not reach its full range. By choosing a lower range of values for the limit min and limit max inputs, you can get a full range of output.

For instance, if you were using a Sound Level Watcher, but the sound input level only reached a maximum of 25 or so, you could set the limit max input of this actor to 25. The incoming values would then be scaled from a range of 0-25 to 0-100.

Input Properties

value: The value to be limited and then scaled.

limit min: The minimum input value. Values arriving at the value input less than this value will be set to this minimum.

limit max: The maximum input value. Values arriving at the value input above this value will be set to this maximum

out min and **out max:** Specifies the minimum output value. After incoming values are limited to the range given by the limit min and limit max inputs, the resulting value is scaled to the range specified by the out min and out max inputs.

Output Properties

output: The limited and scaled output value. Note that the **limit min** and **limit max** settings for this output are automatically updated when you change the out min and out max input properties.

Lines

Superimposes a line of a specified color, size, and position on a video stream.

Input Properties

- **rgb in**: The source video stream on which the line will be superimposed. If you leave this input disconnected, the line will be drawn on a black background. If this stream is in the YUV format, it will automatically be converted to RGB.
- **start horz**: The horizontal coordinate for the starting point of the line, specified as a percentage of the stage width from –200 to 200. A vertical position of zero is halfway between the top and bottom edge.
- **start vert**: The vertical coordinate for the starting point of the line, specified as a percentage of the stage height from –200 to 200. A vertical position of zero is halfway between the top and bottom edge.
- **end horz**: The horizontal coordinate for the ending point of the line.
- **end vert**: The vertical coordinate for the ending point of the line.
- **line size**: The size of the shape's frame, expressed as a percentage of the stage width from 0 to 50.
- **line color**: The color of the line.
- **trigger**: The line is drawn when a trigger is received at this input. This is necessary so that you can set the starting and ending coordinate without seeing the line move.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **rgb out**: The line superimposed at on the input video stream in RGB format.

Listener

Receives a value from a Broadcaster actor.

Listeners are primarily used to receive values sent by Broadcasters in a secondary active Scene. (See the Activate Scene actor for more information on secondary Scenes.) Whenever a Broadcaster actor sends a new value, and the channel on which it was transmitted matches that specified by the channel property of this actor, the value will be echoed to the Listener's value output.

You can also use the Broadcaster/Listener pairs within the same scene if desired, since values are broadcast to *all* active scenes.

Input Properties

- **channel**: Specifies the channel on which this Listener will receive values. This actor will only "hear" values sent by Broadcaster actors who are broadcasting on a matching channel.
- **type**: Specifies the type of data that will be received by this actor. Setting this property controls the type of the value output property. Note that type conversion will still take place if possible, e.g., if a float is received and this property is set to integer, the floating-point value will be converted to an integer.

Output Properties

- **value**: Whenever a value is received from a Broadcaster, it is sent out of this output. Note that his input is mutable, in that it will change its type (integer, float, video, etc.) to match that specified by the type input property.
- **trigger**: Whenever a value is sent out of the value output property, this output trigger is pulsed..

Logical Calculator (v1.1)

Performs logical, bitwise calculations on two numeric values.

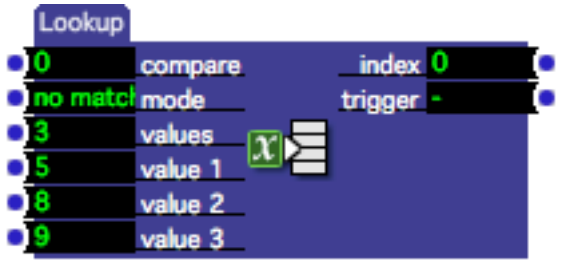
Properties

- **operation**: Determines the operation to be performed on the two numbers. You may choose *and*, *or*, *xor*, *sl (for shit left)*, or *sr (for shift right)*.

- **value1:** the first value for the operation. This number will always be converted to an integer (i.e., the portion after the decimal point will be discarded.)
- **value2:** the second value for the operation. This number will always be converted to an integer (i.e., the portion after the decimal point will be discarded.)
- **output:** the result of the calculation. For the five different operations, this value is calculated as follows:

and	bitwise logical and of value1 and value2
or	bitwise logical or of value1 and value2
xor	bitwise logical exclusive or of value1 and value2
sl	value1 is shifted left by the number of bits specified by value2
sr	value1 is shifted right by the number of bits specified by value2

Lookup (v1.1)



Looks up a value in a table of values, outputting the index of the matched value.

The Lookup actor shown above is configured to have three value inputs, which are set to 3, 5 and 8. If the value 3 was sent to the compare input, the index output would be set to 1 and the trigger output would send a trigger; if the value 5 was sent to the compare input, the index output would be set to 2, etc. If the value 22 was sent to the compare input, the index output would be set to 0, since no match was found. (You can prevent a value from being sent when there is no match using the mode input.)

Input Properties

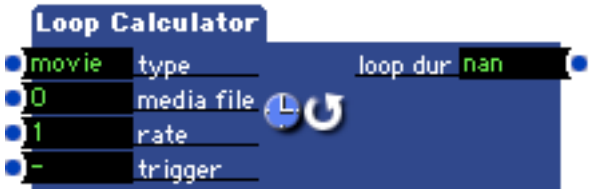
- **compare**: Each time this value changes, it is compared to all values in the table. If a match is found, the index of that value is sent to the index output and the trigger output sends a trigger.
- **mode**: Determines what will happen if a value arriving at the compare input cannot be found in the list of values specified by the value inputs. When set to no match, the output index is set to 0 when a match cannot be found. When set to match, the output index will be set only when the compare input matches one of the values specified by the value inputs.

- **values**: Sets the number of values in the lookup table. Increase this value to add input values, decrease it to remove input values.
- **value 1, value 2, etc**: The values in the lookup table.

Output Properties

- **index**: When the compare input changes, and a match is found in one of the value inputs, sends the index of the value that was matched.
- **trigger**: When the compare input changes, and a match is found in one of the value inputs, sends a trigger.

Loop Calculator



Calculates a 'play length' percentage for a specific movie or sound based on the tempo measured at the trigger input

The Loop Calculator is useful when you want the 'play length' (i.e., loop length) of a Movie or Sound player to match the beat of music you are hearing. Typically, one would connect the output of a Keyboard Watcher to the trigger input, and tap the beat of the music using the computer keyboard.

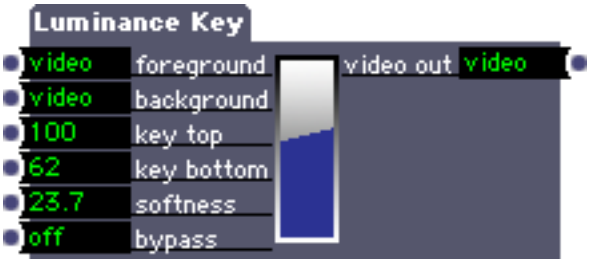
Input Properties

- **type**: Specifies the media type of the file to be controlled. Can be either 'movie' or 'sound'.
- **media file**: Specifies the number of the media file for which the loop will be calculated, as shown in the Media Window. When the type input is set to **movie**, then this is the number of a movie file; when set to **sound** it is the number of a sound file.
- **rate**: The playback rate of the media file. The default setting is 1.0. If the media file that you intend to loop plays at a rate other than 1.0, you should adjust this setting to match that found in the Movie or Sound Player actor. Otherwise, the duration of the loop will not be calculated correctly.
- **trigger**: Trigger this input to measure the tempo of the music being heard and calculate the loop duration. You can connect any trigger output to this input, but a typical usage would have this input connected to the output of a **Keyboard Watcher** actor, so that the computer operator can tap the tempo using the computer keyboard.

Output Properties

loop dur: Connect this output to the play length input of a Movie Player or Sound Player actor to adjust the length of the media's loop based on the tempo measured at the trigger input. Note that both the media file and rate specified in this actor must match the corresponding values in the Movie or Sound player that is being controlled for the loop duration value to be calculated correctly.

Luminance Key



"Keys" two video streams together, allowing the background video stream to show through on the foreground wherever the brightness of the foreground is within a range of brightness.

The Luminance Key module uses the brightness of the foreground image to determine whether you see the foreground video stream or background video stream at the output.

In the Luminance Key actor, you determine the range of brightness by adjusting the key top and key bottom properties. Where ever the brightness of the foreground image is between these two values (0 being black, 100 being white, 50 being gray) you will see the foreground image. When the brightness is outside this range, you will see the background. The sharpness of the edge between the foreground and background image can be adjusted using the softness property.

Here is an example.

Foreground

Background

Output

The dark background behind the dancer a good, consistent brightness (or *luminance*) that we can use to key the background image onto the foreground. In this example, the key top was set at 100, the key bottom was set at 5, and the softness was set to 5. Wherever the brightness of the foreground image is inside the range of 5% to 100% you see the foreground. Where it is outside this range (0% to 5%) the background image shows through. The edges between the foreground and background images is softened somewhat because we set the softness property to 5.

To help you understand what brightness you are specifying with the key top and key bottom values, there is a diagram displayed in the center of the actor that represents those properties. It gives you graphic feedback by showing the range of brightness that will allow you to see the foreground image. The slope at the top and the bottom represents the softness property.

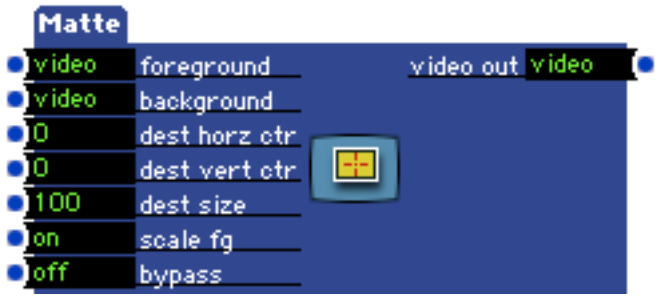
Input Properties

- **foreground**: The foreground video stream. Areas of this stream will be seen when its brightness falls within the range specified by the key top and key bottom properties.
- **background**: The background video stream will appear superimposed on the foreground where the foreground brightness falls outside the range the key top and key bottom properties. If you do not connect any video stream to this input, the background defaults to black.
- **key top**: Specifies the top of the range of brightness that will allow you to see the foreground image.
- **key bottom**: Specifies the bottom of the range of brightness that will allow you to see the foreground image.
- **softness**: Determines how "hard" the edge between the foreground and background images is. Experiment to see what setting looks best.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **video out**: The resulting keyed video image.

Matte

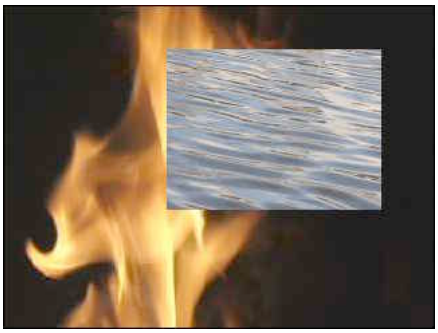


Overlays a scaled foreground video stream on a background video stream.

The entire foreground image is scaled to the size given by the dest size property, and matted on to the background image so that it's center is at the point specified by the horizontal and vertical center properties.

For a higher degree of control (e.g., to scale *part* of the source image onto the background) please see the Matte++ actor in the next section.

Here is an example.



Example Matte
Horz Center = 13% Vertical Center = -12% Size = 50%

Input Properties

- **foreground**: The video source that will be matted onto the background..
- **background**: The video source onto which the foreground will be matted
- **dst horz ctr**: Sets the vertical center of the area within the background video into which the source will be matted, from -100 to 100 percent of the background video's width.
- **dst horz size**: Sets the horizontal size of the area within the background video into which the source will be matted, from 0 to 100 percent of the background video's width.
- **scale fg**: When turned off, prevents the foreground image from being scaled. Normally, if two incoming video streams to be combined are not the same size, Isadora will scale one of the two videos so that their sizes match, even if this were to distort the aspect ratio of one of the two streams. You can prevent the foreground image from being scaled (and thus preserve its aspect ratio relationship to the background) by turning this property off.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **video out**: The resulting matted video image.

Matte++

Overlays a scaled, zoomed and/or panned foreground video stream on a background video stream.

A portion of foreground image is scaled to the size given by the dest horz size and dest vert size properties, and matted on to the background image so that it's center is at the point specified by the dst horz ctr and dst vert ctr properties.

The area of the foreground image that will be matted on to the background is set by four properties. The size is specified by src horz size and src vert size, which are specified as a percentage of the source image's size. When set to 100, all of the foreground video stream will be seen. Smaller values show less, which has the visual effect of zooming in. The src horz ctr and src vert ctr properties determine the center point of that area within the foreground image.

Note that as the src horz size and src vert size parameters decrease in value, the effect of the src horz ctr and src vert ctr will become more profound. When the two source size parameters are set to their maximum (100%), changing the center parameters will have no effect because there is nowhere left to move.

Here is an example.

Matte++ Example

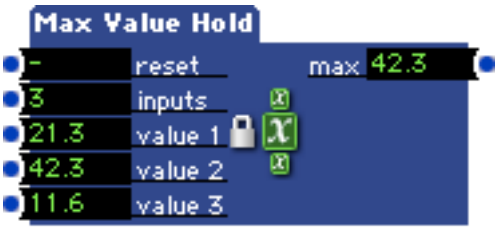
Input Properties

- **foreground**: The video source that will be matted onto the background..
- **background**: The video source onto which the foreground will be matted
- **src horz ctr**: Sets the horizontal center of the area within the source video that will be matted onto the background, from -100 to 100 percent of the foreground video's width.
- **src horz ctr**: Sets the vertical size of the area within the source video that will be matted onto the background, from -100 to 100 percent of the foreground video's height.
- **src horz size**: Sets the horizontal size of the area within the source video that will be matted onto the background, from 0 to 100 percent of the foreground video's width.
- **src horz size**: Sets the vertical size of the area within the source video that will be matted onto the background, from 0 to 100 percent of the foreground video's height.
- **dst horz ctr**: Sets the horizontal center of the area within the background video into which the source will be matted, from -100 to 100 percent of the background video's width.
- **dst horz ctr**: Sets the vertical center of the area within the background video into which the source will be matted, from -100 to 100 percent of the background video's width.
- **dst horz size**: Sets the horizontal size of the area within the background video into which the source will be matted, from 0 to 100 percent of the background video's width.
- **dst horz size**: Sets the vertical size of the area within the background video into which the source will be matted, from 0 to 100 percent of the background video's width.
- **scale fg**: When turned off, prevents the foreground image from being scaled. Normally, if two incoming video streams to be combined are not the same size, Isadora will scale one of the two videos so that their sizes match, even if this were to distort the aspect ratio of one of the two streams. You can prevent the foreground image from being scaled (and thus preserve its aspect ratio relationship to the background) by turning this property off.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **video out**: The resulting matted video image.

Max Value Hold



Outputs the maximum value that has been received since the last reset.

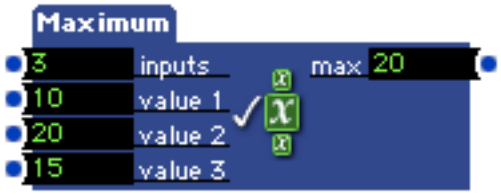
Input Properties

- **reset**: Resets the output to zero.
- **inputs**: Specifies the number of value inputs for this actor, from 1 to 16.
- **value 1, value 2, etc.**: When a value arrives at one of these inputs, it is compared to the output. If it is greater than the output, the new value is stored and sent out of the output port. If a value arrives that is less than the current value of the output, nothing happens.

Output Properties

- **max**: The maximum value that has been received since the last reset.

Maximum



Outputs the current maximum value of all of its inputs.

Input Properties

- **inputs**: Specifies the number of value inputs for this actor, from 1 to 16.
- **value 1, value 2, etc.**: When a value arrives at one of these inputs, it is compared to all of the other value inputs. If it is the greatest of all of these, the new value is sent out of the output port. If a value arrives that is less than or equal to any of the other input values, nothing happens.

Output Properties

- **max**: The current maximum value of all of the value inputs.

Midi Enable

Enables or disables MIDI input.

There occasionally may be situations where you want to temporarily disable all MIDI input. The MIDI Enable actor allows you to accomplish this goal.

Input Properties

- **function:** When set to disable, a trigger a the trigger input will disable all MIDI input. When set to enable and a trigger is received, MIDI input is enabled.
- **trigger**: Enables or disables MIDI input when a trigger is received, depending on the setting of the function input.

Midi Player

Plays a standard MIDI file to the specified MIDI port.

There are three main things that you can control when manipulating the playback of a standard MIDI file: its speed, the portion of the file that will play and whether or not that portion will loop, and the velocity of its note on messages.

The portion of the sound that will play is called the *play segment*. The play segment is determined by the play start and play length properties, both of which are expressed as a percentage of the MIDI file's total length. The play length indicates how long the play segment will be, while the play start specifies where that chunk will start. For example, with a MIDI file that was 60 measures long, a play start of 50% and a play length of 10% would indicate that the play segment would start at measure 31 (30 measures from measure 1) and have a duration of 6 measures. You

can choose to play this segment continuously by turning the loop enable property on.

The green bar at the bottom of the actor shows the play segment in bright green. The thin yellow line that moves across that bright green bar indicates the current position.

Input Properties

- **midi file**: The number of the MIDI file you want to play, as shown in the Media Window. When the number of a valid movie is entered here, its name will appear to the right of the number.
- **port**: The MIDI port to which the file's MIDI data will be sent. These port numbers correspond to the Destinations shown in the MIDI Setup dialog.
- **channel**: When this value is set to 0, the channel given in the MIDI file itself is used. If this value is set to a number between 1 and 16, all MIDI messages in the file are forced to that channel.
- **restart**: When triggered, starts playing from the position specified by the play start parameter.
- **stop**: Stops playing the MIDI file, turning off any sounding notes.
- **velocity mod**: When set to 100, the Note On messages are sent with the velocity specified in the MIDI file. When set to values between 0 and 99, the Note On velocities are scaled by that percentage. For instance, if this property were set to 50%, and the note on in the file had a velocity of 64, it would be sent out with a velocity of 32.
- **play start**: Determines the starting point of the play segment (the portion of the MIDI file that will play) as a percentage of the file's total duration, ranging from 0 to 100.
- **play length**: Determines the length of the play segment (the portion of the MIDI file that will play) as a percentage of the file's total duration, ranging from 0 to 100.
- **loop enable**: When this property is turned off, the play segment will play once each time the restart input is triggered. When turned on, once the file starts playing it will continue to play by looping back to the start of the play segment each time the end of that segment is reached.

Min Value Hold

Outputs the minimum value that has been received since the last reset.

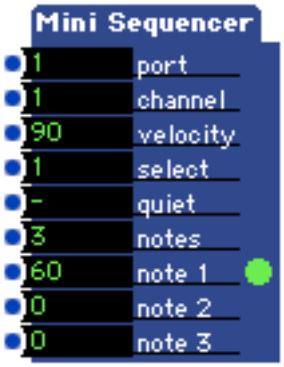
Input Properties

- **reset**: Resets the output to MAX.
- **inputs**: Specifies the number of value inputs for this actor, from 1 to 16.
- **value 1, value 2, etc.**: When a value arrives at one of these inputs, it is compared to the output. If it is less than the output, the new value is stored and sent out of the min output port. If a value arrives that is greater than the current value of the output, nothing happens.

Output Properties

- **min**: The minimum value that has been received since the last reset.

Mini Sequencer



Sends a sequence of MIDI notes.

The Mini Sequencer is designed to allow you to trigger individual MIDI notes from a set you define. You specify the number of notes by setting the notes property, and then enter the pitches in properties labeled note 1, note 2, etc. Two things happen each time you send a value to the select input. First, a note off message is sent for any previously sounding notes. Then, the pitch associated with the selected note property will be sent to MIDI port and channel specified by the port and channel properties. The note continues to sound until you 1) send another note, 2) trigger the quiet input, or 3) leave the scene.

A green dot will appear next to the note that is currently sounding. If there is no currently sounding note, the green dot will not be shown.

You can use you can use the **Integer Counter** to drive the select input and send the notes out in the order you have specified. Or use the **Random** actor to randomly select the notes to be played.

Input Properties

- **port**: The MIDI port on which the message will be sent. These port numbers correspond to the Destinations shown in the MIDI Setup dialog.

- **channel**: The MIDI Channel on which the message will be sent.
- **velocity**: The velocity for the next Note On message.
- **select**: When a new value arrives at this input, sends a MIDI Note On message with the pitch given by the corresponding note input, i.e., if you input the value 3 here, a Note On message will be sent with the pitch given by the note 3 input property
- **quiet**: Sends a note off message for any currently sounding notes.
- **note 1, note 2, note 3**: The pitches for the Note On messages to be sent, as chosen by the select input.

Minimum

Outputs the current minimum value of all of its inputs.

Input Properties

- **inputs**: Specifies the number of value inputs for this actor, from 1 to 16.
- **value 1, value 2, etc.**: When a value arrives at one of these inputs, it is compared to all of the other value inputs. If it is the least of all of these, the new value is sent out of the output port. If a value arrives that is greater than or equal to than the any of the other input values, nothing happens.

Output Properties

- **min**: The current minimum value of all of the value inputs.

Mono Pressure Watcher

Watches for MIDI Monophonic Pressure messages, outputting the values associated with that message and sending a trigger when one is seen.

The Mono Pressure Watcher can look for a message with a specific pressure value or a range of pressure values depending on the setting of the input properties. When a message meeting all of the criterion specified by input properties is seen, the

values associated with that message are sent out of the output ports and a trigger is sent out of the trigger output.

Input Properties

- **port**: Specifies the MIDI Port on which the message must arrive to be seen. These port numbers correspond to the ports shown in the MIDI Setup dialog. You may specify a single port or a range of ports.
- **channel**: Specifies the MIDI Channel on which the message must be received before it will be seen by this watcher, from 1 to 16. You may specify a single port or a range of ports.
- **value**: Specifies the pressure value or range of values that will be seen, from 0 to 127.

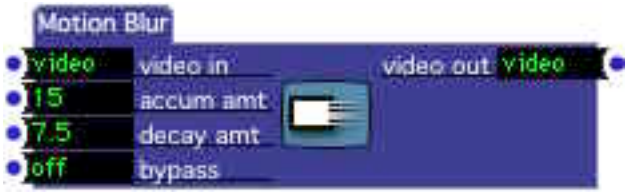
Note that for a Monophonic Pressure message to be seen by this watcher, its values must fall within the range of values for specified by all three of the input properties.

Output Properties

When this watcher sees a Control Change message that falls within the range of values specified by all of the input properties, the following values are sent out of the outputs:

- **port**: The MIDI Port on which the message arrived.
- **channel**: the message's MIDI Channel.
- **pressure**: the message's pressure value.
- **trigger**: sends a trigger each time a message is seen.

Motion Blur (v1.1)



Blurs a video stream by gradually adding in the input video stream while it simultaneously darkens the existing output.

The net effect of Motion Blur is that things that are still in the image (i.e., the background) look normal, but anything that is moving is blurred. Setting the accum amt and decay amt determines the amount of blurring. Higher values mean less blurring, lower values mean more. For best results, the accum amt and decay amt inputs should be set to the same value. However, interesting results can be achieved by setting them to two different values.

Technically, Motion Blur maintains an output buffer that is initially black. As each new frame of video arrives at the video in input, a percentage of it, specified by the accum amt input, is added to the buffer. Simultaneously, the output buffer is darkened by an amount specified by the decay amt input.

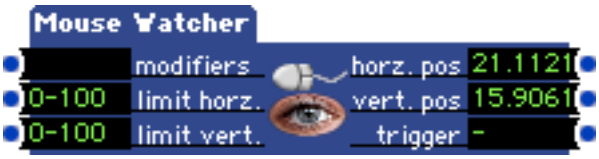
Input Properties

- **video in**: The video input stream
- **accum amt.**: How much of the incoming video stream will be added to the buffer, expressed as a percentage from 0 to 100%. Lower values mean that new frames of video will have less influence on the existing image.
- **decay amt**: How fast the output buffer will tend to darken, expressed as a percentage from 0 to 100%. Higher values mean that the buffer will decay to black faster.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **video out**: The blurred video output stream.

Mouse Watcher



Outputs the current position of the mouse, optionally choosing to see changes in position when specific modifier keys are held down.

Input Properties

- **modifiers**: Specifies the modifier keys that must be held down before mouse movement will be seen by this watcher. Options include:

MacOS	Windows
cmd = d = command key	alt = a = alt key
ctl = c = control key	ctl = c = control key
opt = o = option key	win = w = windows key
shf = s = shift key	shf = s = shift key

Note that when you save a file on MacOS and read it under Windows the **cmd** modifier becomes the **alt** modifier, and **opt** becomes **win**. The reverse is true when you move from Windows to MacOS.

To enter a new set of modifiers, click on the modifiers value edit box and type the codes for modifiers you desire separated by hyphens. (You can use either the three letter or single letter modifiers when typing the new modifiers.) If you wanted the watcher to only see the mouse move when the option and command keys were down, enter opt-cmd and press *enter*.

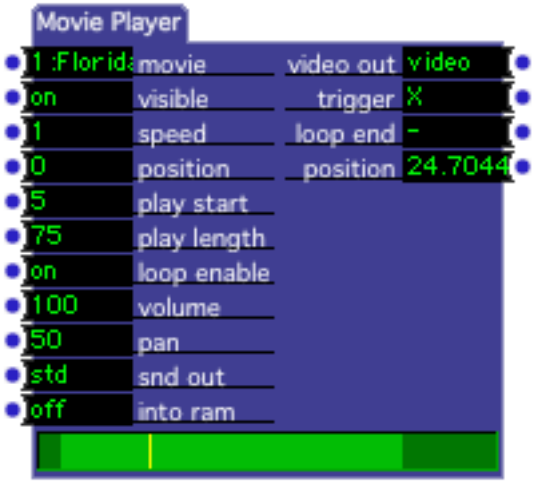
To remove all modifiers, click on the modifiers value edit box, press a space, and press *enter*.

- **limit horz.**: Limits the range of horizontal movement that this watcher will see, specified as a percentage of the width of the main screen. For example, if you set this range to 0-50, the mouse will only be seen moving when it is in the left half of the screen.
- **limit vert.**: Limits the range of vertical movement that this watcher will see, specified as a percentage of the height of the main screen. For example, if you set this range to 50-100, the mouse will only be seen moving when it is in bottom left half of the screen.

Output Properties

- **horz. pos**: The horizontal position of the mouse, ranging between 0% and 100%. This percentage is measured within the range specified in the limit horz input property, not the entire width of the screen. So, if the limit horz property was set to 0-50, and the mouse was 25% of the way across the main screen (i.e., halfway between 0% and 50%) then horz pos. output would be set to 50.
- **vert. pos**: The vertical position of the mouse, ranging between 0% and 100%. This percentage is measured within the range specified in the limit vert input property, not the entire height of the screen. So, if the limit vert property was set to 50-100, and the mouse was 75% of the way down the main screen (i.e., halfway between 50% and 100%) then vert pos. output would be set to 50.
- **trigger**: Sends a trigger every time the horz. pos or vert. pos changes.

Movie Player



Plays a movie to a video stream, allowing control over its playback characteristics

There are three main things that you can control when manipulating the playback of a movie: its speed, the portion of the movie that will play and whether or not that portion will loop, and is sound characteristics.

The portion of the sound that will play is called the *play segment*. The play segment is determined by the play start and play length properties, both of which are expressed as a percentage of the movie's total length. The play length indicates how long the play segment will be, while the play start specifies where that chunk will start. For example, with a movie that was 60 seconds long, a play start of 50% and a play length of 10% would indicate that the play segment would start 30 seconds into the movie and be 6 seconds long. You can choose to play this segment continuously by turning the loop enable property on.

The green bar at the bottom of the actor shows the play segment in bright green. The thin yellow line that moves across that bright green bar indicates the current movie position.

Note that the Movie Player actor does not output video to a Stage. Instead it produces a video stream that can be connected to other video manipulation actors, or that can be connected to the Projector actor to show the video on Stage.

Input Properties

- **movie**: The number of the movie you want to play, as shown in the Media Window. When the number of a valid movie is entered here, its name will appear to the right of the number.
- **visible**: When turned *on* the movie plays and the resulting video stream is sent out of the video out output. When turned *off*, the movie stops playing and is unloaded from memory.
- **speed**: The speed of the movie, from –10 to 10 times normal speed. The default setting is 1.0, which plays the movie forward at normal speed. 0.5 would play the movie forward at half speed. 2.0 plays the movie forward at twice normal speed. Negative values play the movie in reverse.
- **position**: Jumps to the specified position *within the play segment* whenever a new value is received on this input. (The play segment is defined by the play start and play length properties – see below.) This parameter is expressed as a percentage of the play length, from 0 to 100.
- **play start**: Determines the starting point of the play segment (the portion of the movie that will play) as a percentage of the movie's total length, ranging from 0 to 100.
- **play length**: Determines the length of the play segment (the portion of the movie that will play) as a percentage of the movie's total length, ranging from 0 to 100.
- **loop enable**: If this property is turned off, the play segment will play once each time the Movie Player's Scene is activated, or when its visible property is turned

on. If this property is turned on, once the movie starts playing it will continue by looping back to the start of the play segment when the end of that segment is reached.

- **volume**: Sets the volume of the Movie's sound track, if one is present. Expressed as a percentage of the sound track's normal volume.
- **pan**: Controls the panning of the sound, from 0 to 100. 0 is left, 100 is right, 50 is center.
- **snd out**: The sound output routing for this movie's audio. `std` = built-in output, `e1-2` = output on external sound device channels 1 and 2, `e3-4` = output on external sound device channels 3 and 4, etc. If no external device is present when the movie is played, or if that device does not have the requested channels, the sound will be sent to the built-in interface.

  See the section "Using External Multi-Channel Sound Output" on Page 144 for more information.
- **into ram**: When set to true, Isadora attempts to load the entire movie into RAM (Random Access Memory) for faster playback. NOTE: This can consume large amounts of your system's memory - be cautious when using this feature.

Output Properties

- **video out**: The video stream produced by playing the movie.
- **trigger**: Sends a trigger each time a new frame of video appears at the video out port.
- **loop end**: Sends a trigger each time a the end of the play segment is reached.
- **position**: Reports the current position within the play segment.

Movie Player Direct

Plays a movie directly to the stage, allowing control over its playback characteristics.

Movie Player Direct works in the same way as the more often used Movie Player, except that it sends the video directly to one of the Stages. This means that it will give the highest possible frame rate when playing the movie, but that you won't be able to process the video stream with any other actors.

See Movie Player actor above for a definition of the play segment, and other characteristics that these two actors share.

Input Properties

- **movie**: The number of the movie you want to play, as shown in the Media Window. When the number of a valid movie is entered here, its name will appear to the right of the number.
- **visible**: When turned *on* the movie plays and the resulting video stream is sent out of the video out output. When turned *off*, the movie stops playing and is unloaded from memory.
- **speed**: The speed of the movie, from –10 to 10 times normal speed. The default setting is 1.0, which plays the movie forward at normal speed. 0.5 would play the movie forward at half speed. 2.0 plays the movie forward at twice normal speed. Negative values play the movie in reverse.
- **position**: Jumps to the specified position *within the play segment* whenever a new value is received on this input. (The play segment is defined by the play start and play length properties – see below.) This parameter is expressed as a percentage of the play length, from 0 to 100.
- **play start**: Determines the starting point of the play segment (the portion of the movie that will play) as a percentage of the movie's total length, ranging from 0 to 100.
- **play length**: Determines the length of the play segment (the portion of the movie that will play) as a percentage of the movie's total length, ranging from 0 to 100.
- **loop enable (v1.1)**: If this property is turned off, the play segment will play once each time the Movie Player's Scene is activated, or when its visible property is turned on. If this property is set to on, once the movie starts playing it will continue by looping back to the start of the play segment when the end of that segment is reached. When it is set to palindrome, the movie will play forward to the end of the play segment, then play backward to the start of the segment, and so forth.
- **volume**: Sets the volume of the Movie's sound track, if one is present. Expressed as a percentage of the sound track's normal volume.
- **pan**: Controls the panning of the sound, from 0 to 100. 0 is left, 100 is right, 50 is center.
- **snd out**: The sound output routing for this movie's audio. std = built-in output, e1-2 = output on external sound device channels 1 and 2, e3-4 = output on external sound device channels 3 and 4, etc. If no external device is present when

the movie is played, or if that device does not have the requested channels, the sound will be sent to the built-in interface.

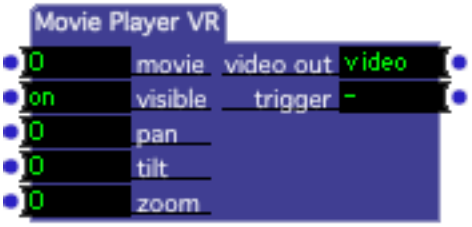
See the section “Using External Multi-Channel Sound Output” on Page 144 for more information.

- **into ram**: When set to true, Isadora attempts to load the entire movie into RAM (Random Access Memory) for faster playback. NOTE: This can consume large amounts of your system’s memory - be cautious when using this feature.
- **stage**: Specifies the stage upon which this movie’s video will appear.

Output Properties

- **loop end (v1.1)**: Sends a trigger each time a the end of the play segment is reached.
- **position (v1.1)**: Reports the current position within the play segment.

Movie Player VR



Plays a QuickTime VR movie to the stage, allowing control over its pan, tilt, and zoom.

Movie Player VR only works with QuickTime VR movies. If you try to use it to play a movie that is not a QuickTime VR movie, you won’t see any output.

Input Properties

- **movie**: The number of the movie you want to play, as shown in the Media Window. When the number of a valid movie is entered here, its name will appear to the right of the number.
- **visible**: When turned *on* the movie plays and the resulting video stream is sent out of the video out output. When turned *off*, the movie stops playing and is unloaded from memory.
- **pan**: The pan (or rotation) of the movie, from 0 to 100 percent of its pan range.
- **tilt**: The tilt of the movie, from 0 to 100 percent of its tilt range
- **zoom**: The zoom (also known as field of view) of the movie, from 0 to 100 percent of its zoom range. Smaller numbers zoom out, larger numbers zoom in.

Output Properties

- **video out**: The video stream produced by playing the movie.

- **trigger**: Sends a trigger each time a new frame of video appears at the video out port.

Multi Blocker

Filters out values that are too closely spaced in time.

Multi Blocker is useful in situations where you have a stream of input values that has so many values that it is overwhelming the input of another actor, or if you have a "noisy" input that generates multiple triggers or values and you only want to see the first of these. Multi Blocker solves this problem by ensuring that a specific amount of time has passed before it will pass the new value from the input to the output.

Note that the value in and value out properties are mutable. When you connect an output to the value in input, both value in and value out mutate their type (trigger, integer, float, video, etc.) and their minimum and maximum values to match those of the output property that was connected to value in. E.g., if you connect a video output to value in, the aforementioned properties change their type to video, if you connect a number output, they all change to numbers, etc.

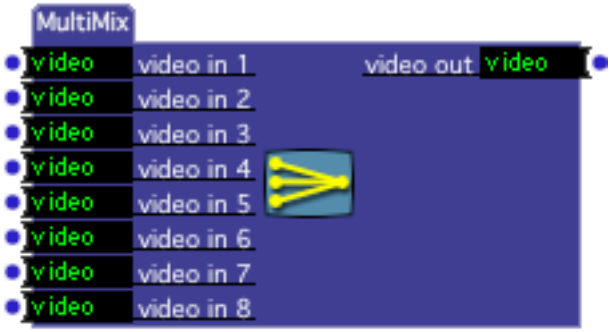
Input Properties

- **value in**: The incoming stream of values.
- **time**: The minimum amount of time that must pass between values, given in seconds. If two or more values arrive with less than this amount of time between them, only the first value is sent to the output.

Output Properties

- **value out**: The filtered stream of values from the input, with at least the amount of time specified by the time input property between them.

MultiMix (v1.1)



Sums up to eight video streams into one output.

MultiMix is a little bit like the Video Mixer – it allows you mix several video streams together. The difference (aside from the number of inputs) is that MultiMix "sums together" up to eight streams of video, literally adding their pixels together to each other to produce the output. With the Video Mixer's mix input set to 50%, each of the images is darkened before the two are added together, allowing you to produce crossfades. With MultMix, you can add together two or more video streams without reducing their brightness.

Input Properties

- **video in 1-8**: Video streams to be summed together.

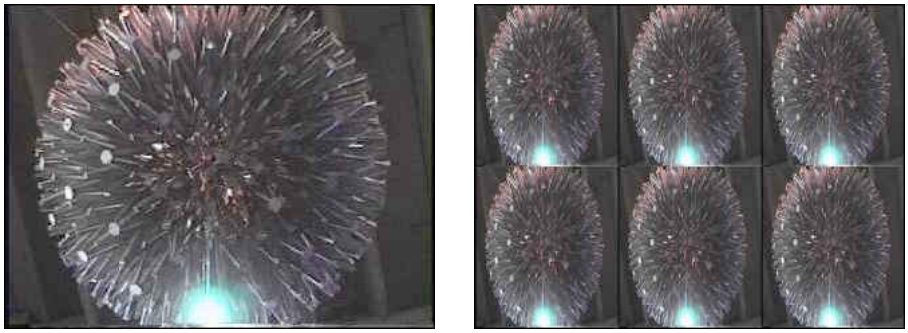
Output Properties

- **video out**: The "summed" video output stream.

MultiVid

Makes multiple copies of the source video, arranged as a grid of images.

MultiVid allows you to "tile" an incoming video stream, creating a grid made up of multiple copies of the original. You can specify the number of rows and columns in the grid. You may optionally choose to copy the images sequentially, i.e., each time a new frame of video arrives, copy it to the next position in the grid. This option creates interesting delay effects as you see the sequential frames appear in the grid.



MultiVid – Original Image and Result (3 Columns, 2 Rows)

Input Properties

- **video in**: The incoming video stream.
- **columns**: The number of columns in the output grid, from 1 to 16.
- **rows**: The number of rows in the output grid, from 1 to 16.
- **mode**: When set to simul, the incoming video stream is copied to all of the grid positions simultaneously. When set to scan each new frame that arrives at the input is copied to the next position in the grid, moving from left to right and then top to bottom.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **video out**: The "tiled" video output stream.

Net Broadcaster

Sends a numeric value to other computers on a Local Area Network.

Net Broadcaster allows you to send values from one computer to another when they are connected via a local area network. Whenever a numeric value is received at the Net Broadcaster's value input, that value is "broadcast" to over the local area network on the channel specified by the channel input property. Any copy of Isadora on the LAN whose Net ID matches the specified target id, and who has an active Listener actor set to receive on a matching channel will "hear" the broadcast value and send that value to its value output. Note that if the Net Broadcater's

target id is set to 0, then all machines on the network will receive the broadcast values, regardless of their Net ID.

Currently you can only send numeric values using the Net Broadcaster. You cannot send video or audio data.

For this module to work, the following conditions must be true:

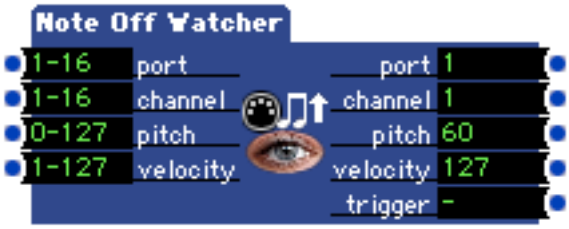
1) The computers are connected by a local area network. This network can be a physical, Ethernet connection, a wireless connection, or any other hardware that supports the TCP/IP protocol. The actual address doesn't matter, as Isadora uses a technique called "multi-casting" that does not require the sender to know the IP address of the target. What does matter is that your machine has a valid address.

2) The computers must have a valid TCP/IP address when Isadora is *started up*. (On MacOS 9, open the TCP/IP control panel and choose **File > Get Info.** If the dialog box reports a valid address for "This Macintosh" under the heading Addresses, then you are ready to go.)

Input Properties

- **target id**: When this input is set to 0, the message will be received by every machine on the network. When it is non-zero, then only the machine whose Net ID matches the specified value will receive the message. The Net ID can be set in the Preferences under the "Net" tab.
- **channel**: Specifies the channel on which this value will be broadcast. Only Listener actors whose channel input property the value specified here will "hear" the broadcast.
- **value**: Whenever a numeric value is received at this input, it is broadcast over the LAN with the target id and channel specified. Note that his input is mutable, in that it will change its type (integer, float, etc.) to match that of the output property to which it is linked.

Note Off Watcher



Watches for MIDI Note Off messages, outputting the values associated with that message and sending a trigger when one is seen.

The Note Off Watcher can look for a specific Note Off message or a range of messages depending on the setting of the input property values. When a message

meeting all of the criterion specified by input properties is seen, the values associated with that message are sent out of the output ports and a trigger is sent out of the trigger output.

Input Properties

- **port**: Specifies the MIDI Port on which the message must arrive to be seen. These port numbers correspond to the ports shown in the MIDI Setup dialog. You may specify a single port or a range of ports.
- **channel**: Specifies the MIDI Channel on which the message must be received before it will be seen by this watcher, from 1 to 16. You may specify a single port or a range of ports.
- **pitch**: Specifies the MIDI pitch or range of pitches that will be seen, from 0 to 127 or C-2 to G8. (You can choose to see the pitches using their note names by clicking on the title pitch next to the value edit box and choosing **Display > MIDI Note**.)
- **velocity**: Specifies the velocity or range of velocities that will be seen, from 1 to 127. (A velocity of 0 means that this is a Note Off message, per the MIDI Specification.)

For a Note Off message to be seen by this watcher, its values must fall within the range of values for specified by all four of the input properties.

Output Properties

When this watcher sees a Note Off message that falls within the range of values specified by all four of the input properties, the following values are sent to the outputs:

- **port**: The MIDI Port on which the message arrived.
- **channel**: The Note Off message's MIDI Channel.
- **pitch**: The Note Off message's pitch.
- **velocity**: The Note Off message's velocity.
- **trigger**: Sends a trigger each time a message is seen.

Note On Watcher

Watches for MIDI Note On messages, outputting the values associated with that message and sending a trigger when one is seen.

The Note On Watcher can look for a specific Note On message or a range of messages depending on the setting of the input property values. When a message meeting all of the criterion specified by input properties is seen, the values associated with that message are sent out of the output ports and a trigger is sent out of the trigger output.

Input Properties

- **port**: Specifies the MIDI Port on which the message must arrive to be seen. These port numbers correspond to the ports shown in the MIDI Setup dialog. You may specify a single port or a range of ports.
- **channel**: Specifies the MIDI Channel on which the message must be received before it will be seen by this watcher, from 1 to 16. You may specify a single port or a range of ports.
- **pitch**: Specifies the MIDI pitch or range of pitches that will be seen, from 0 to 127 or C-2 to G8. (You can choose to see the pitches using their note names by clicking on the title pitch next to the value edit box and choosing **Display > MIDI Note**.)
- **velocity**: Specifies the velocity or range of velocities that will be seen, from 1 to 127. (A velocity of 0 means that this is a Note Off message, per the MIDI Specification.)

For a Note On message to be seen by this watcher, its values must fall within the range of values for specified by all four of the input properties.

Output Properties

When this watcher sees a Note On message that falls within the range of values specified by all four of the input properties, the following values are sent to the outputs:

- **port**: The MIDI Port on which the message arrived.
- **channel**: The Note On message's MIDI Channel.
- **pitch**: The Note On message's MIDI Pitch.
- **velocity**: The Note On message's velocity.
- **trigger**: Sends a trigger each time a message is seen.

OSC Listener (v1.1)

Receives Open Sound Control messages from another application, which may be running on the same computer as Isadora or which may be running on a computer connected to your computer via a local area network.

Open Sound Control is a standardized way to send high-resolution data from one application to another. The OSC Receive actor allows Isadora to receive values from another application. For more information on Open Sound Control, please refer to “Open Sound Control Support” on Page 139.

Note: values sent to Isadora must include OSC “type tag” information – otherwise Isadora will not recognize the values.

Input Properties

- **channel**: The channel on which messages will be received. Isadora has 32 input channels, with OSC addresses ranging from **/isadora/1** to **/isadora/32**. When sending data from the other computer, you must transmit to the correct address for the OSC Receive actor to see the data. For example, if channel is set to 5, then messages received on the **/isadora/5** OSC channel will be seen by this listener.
- **type**: This determines the type of the value output. When this is set to float, the output type will be a floating-point number. When this is set to integer, the output will be an integer. If you select the latter, and the other application sends a floating-point number, the part after the decimal point will be discarded.

Input Properties

- **value**: When a value is received on the channel specified by the channel input, it will be sent out of this output.
- **trigger**: sends a trigger whenever a value is sent out of the value output.

OSC Transmit (v1.1)

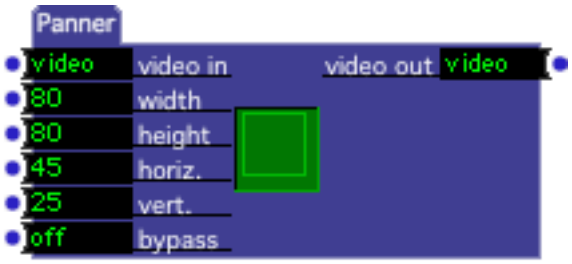
Sends Open Sound Control messages to another application running on the same computer, or to one running on another computer connected via a local area network.

Open Sound Control is a standardized way to send high-resolution data from one application to another. The OSC Transmit actor allows Isadora to send values to another application. For more information on Open Sound Control, please refer to “Open Sound Control Support” on Page 139.

Input Properties

- **udp addr**: The IP address of the computer on which the target application is running. You can use the special address **localhost** to send data to an application running on the same computer as Isadora.
- **port**: The UDP port number on which the program is receiving data. Check the target application to see the UDP port on which it is received.
- **address**: The OSC address to which the data will be sent. Check the documentation for the target application to find out the names of the OSC addresses it supports.
- **use type**: When turned on, the "type tag" information is sent along with the packet. **If you are sending data to another copy of Isadora, this flag must be turned on** – otherwise the other copy of Isadora won't receive the messages.
- **value**: The value to transmit. Each time a new value arrives at this input, an OSC packet with that value is transmitted to the UDP address, port, and OSC address specified in the udp addr, port and addr inputs.

Panner



Pans left and right and/or up and down within a source video image.

Panner is the cousin of the Zoomer actor – the results are similar, but the way in which you control the panning is slightly different. You start by giving the width and height of the "source rectangle", that is, the rectangle that determines how much of the source image you will see. You can visualize this by looking at the graphic in the center of the actor. The green area is the size of the frame, the light green rectangle is the portion that you can see.

You then control the panning by manipulating the horz and vert properties. This moves the source rectangle around within the source video image, controlling which part of the source image you see at the output. Note that the lower the values of the width and height properties, the more you will be able to pan. This is because more of the source image is "left over" – again use the graphic in the center of the actor to visualize this.

Input Properties

- **video in**: The video input stream.

- **width**: Specifies how much of the source image you will see horizontally, from 0 to 100 percent of the source image's width. The smaller this value, the more "zoomed in" you are horizontally.
- **height**: Specifies how much of the source image you will see vertically, from 0 to 100 percent of the source image's height. The smaller this value, the more "zoomed in" you are vertically.
- **horz**: Specifies the horizontal position of pan, from 0 to 100 percent. How much you can pan depends on the setting of the width property. When width is close to 100, you won't be able to pan much because there isn't much of the source image left over.
- **vert**: Specifies the vertical position of pan, from 0 to 100 percent. How much you can pan depends on the setting of the height property. When height is close to 100, you won't be able to pan much because there isn't much of the source image left over.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **video out**: The panned video output.

Pass Value (v1.1)

Only allows values to pass through to the output when they are within a specified range.

Input Properties

- **value**: the value to be compared to the low and high value inputs
- **minimum:** the low value to which the value input will be compared.
- **maximum:** the high value to which the value input will be compared

Output Properties

- **output:** When a value arrives a the value input, and it is within the range specified by minimum and maximum, the value is sent out of this output. If it is outside the specified range, the incoming value is discarded.

Picture Player

Generates a video stream from a picture imported into in the Media Window.

The output of the picture player can be connected to any actor that has a video input. Unlike the Movie Player, which sends a frame of video on a periodic basis when the movie is playing, the Picture Player only sends a new frame of video when 1) its Scene is activated, 2) its visible property goes from *off* to *on*, or 3) the picture property changes from one valid picture to another.

Input Properties

- **picture**: The number of the picture you want to play, as shown in the Media Window. When the number of a valid picture is entered here, its name will appear to the right of the number.
- **visible**: When set to *on*, generates a video stream from the picture specified by the picture input property. When set to *off*, no output is generated.

Output Properties

- **video out**: The picture, converted into a video stream.
- **trigger**: Sends a trigger whenever a new picture is selected, when the visible property goes from *off* to *on*, or when this actor's Scene is activated.

Pitch Bend Watcher

Watches for MIDI Pitch Bend messages, outputting the values associated with that message and sending a trigger when one is seen.

The Pitch Bend Watcher can look for a message with a specific pitch bend value or a range of bend values depending on the setting of the input properties. When a message meeting the criterion specified by all of the input properties is seen, the values associated with that message are sent out of the output ports and a trigger is sent out of the trigger output.

Input Properties

- **port**: Specifies the MIDI Port on which the message must arrive to be seen. These port numbers correspond to the ports shown in the MIDI Setup dialog. You may specify a single port or a range of ports.
- **channel**: Specifies the MIDI Channel on which the message must be received before it will be seen by this watcher, from 1 to 16. You may specify a single port or a range of ports.
- **bend value**: Specifies the pitch bend value or range of values that will be seen, from 0 to 16383. 8192 is the center position of the pitch bend.

Note that for a Monophonic Pressure message to be seen by this watcher, its values must fall within the range of values for specified by all three of the input properties.

Output Properties

When this watcher sees a Control Change message that falls within the range of values specified by all of the input properties, the following values are sent out of the outputs:

- **port**: The MIDI Port on which the message arrived.
- **channel**: The Pitch Bend message's MIDI Channel.
- **bend value**: The Pitch Bend message's bend value.
- **trigger**: Sends a trigger each time a message is seen.

Poly Pressure Watcher

Watches for MIDI Polyphonic Pressure messages, outputting the values associated with that message and sending a trigger when one is seen.

The Poly Pressure Watcher can look for a specific Polyphonic Pressure message or a range of messages depending on the setting of the input property values. When a message meeting all of the criterion specified by input properties is seen, the values associated with that message are sent out of the output ports and a trigger is sent out of the trigger output.

Input Properties

- **port**: Specifies the MIDI Port on which the message must arrive to be seen. These port numbers correspond to the ports shown in the MIDI Setup dialog. You may specify a single port or a range of ports.

- **channel**: Specifies the MIDI Channel on which the message must be received before it will be seen by this watcher, from 1 to 16. You may specify a single port or a range of ports.
- **pitch**: Specifies the MIDI pitch or range of pitches that will be seen, from 0 to 127 or C-2 to G8. (You can choose to see the pitches using their note names by clicking on the title pitch next to the value edit box and choosing **Value > MIDI Note**.)
- **pressure**: Specifies the pressure value or range of values that will be seen, from 0 to 127.

For a Polyphonic Pressure message to be seen by this watcher, its values must fall within the range of values for specified by all four of the input properties.

Output Properties

When this watcher sees a Polyphonic Pressure message that falls within the range of values specified by all four of the input properties, the following values are sent to the outputs:

- **port**: The MIDI Port on which the message arrived.
- **channel**: The Polyphonic Pressure message's MIDI Channel.
- **pitch**: The Polyphonic Pressure message's MIDI Pitch.
- **pressure**: The Polyphonic Pressure message's pressure.
- **trigger**: Sends a trigger each time a message is seen.

Program Change Watcher

Watches for MIDI Program Change messages, outputting the values associated with that message and sending a trigger when one is seen.

The Program Change Watcher can look for a message with a specific program change number or a range of numbers depending on the setting of the input properties. When a message meeting all of the criterion specified by input properties is seen, the values associated with that message are sent out of the output ports and a trigger is sent out of the trigger output.

Input Properties

- **port**: Specifies the MIDI Port on which the message must arrive to be seen. These port numbers correspond to the ports shown in the MIDI Setup dialog. You may specify a single port or a range of ports.

- **channel**: Specifies the MIDI Channel on which the message must be received before it will be seen by this watcher, from 1 to 16. You may specify a single port or a range of ports.
- **prog num**: Specifies the program number or range of numbers that will be seen, from 0 to 127.

Note that for a Program Change message to be seen by this watcher, its values must fall within the range of values for specified by all three of the input properties.

Output Properties

When this watcher sees a Program Change message that falls within the range of values specified by all of the input properties, the following values are sent out of the outputs:

- **port**: The MIDI Port on which the message arrived.
- **channel**: The Program Change message's MIDI Channel.
- **prog num**: The Program Change message's program number.
- **trigger**: sends a trigger each time a message is seen.

Projector

Sends a video stream to one of the stages.

To be able to see a video stream on one of the Stages, you will need to use the Projector actor. It does the work of rendering the video stream to a Stage, optionally allowing you to scale the resulting video image and control its placement.

Input Properties

- **video in**: The video stream that will be shown on the stage.

- **left**: Where the left edge of the video frame will be placed, from 0 to 100 percent of the stage width. Higher numbers move the video image to the right.
- **top**: Where the top of the video frame will be placed, from 0 to 100 percent of the stage height. Higher numbers move the video image lower.
- **width**: The width of the projected video image, from 0 to 100 percent of the stage width.
- **height**: The height of the projected video image, from 0 to 100 percent of the stage height.
- **zoom**: The zoom factor of the projected video image, from 0 to 1000 percent of the stage size. 100 percent will project an image that fills the stage. Lower zoom out, higher numbers zoom in.
- **blend (v1.1 + HAR):** Determines the opacity of the video image in conjunction with the intensity input. When set to additive, the image is added to the background image – lower intensity settings reduce the brightness of the image. When set to transparent, lower intensity values make the object more transparent, allowing you to see more of the image underneath. When set to opaque, lower intensity values will fade the image to a black background that obscures the background image. This feature only works when **Hardware Accelerated Rendering** is turned on in the Preferences.

  IMPORTANT: When attempting to render a transparent image, it is essential that it is rendered last, otherwise the transparent image feature may not work. (Generally this will result in on of the lower images appearing opaque and "on top of" the transparent image.) To specify the order in which Projectors render their images, use the layer input. Higher layer numbers are drawn last, so you will want to use a higher layer number for Projectors whose blend input is set to transparent.
- **intensity (v1.1 + HAR)**: Sets the brightness or transparency of the image, from 0 to 100%. See blend input for a complete description. This feature only works when **Hardware Accelerated Rendering** is turned on in the Preferences.
- **spin (v1.1 + HAR)**: Specifies the rotation of the image, from –360 to +360 degrees. This feature only works when **Hardware Accelerated Rendering** is turned on in the Preferences.
- **spin (v1.1 + HAR)**: Specifies the aspect ratio of the image from –100 to +100. Value less than zero make the image less tall, values higher than zero make the image less wide. This feature only works when **Hardware Accelerated Rendering** is turned on in the Preferences.
- **perspective (v1.1 + HAR)**: Allows you to change the horizontal perspective of the image, from –200 to +200. Vales less than zero make the right edge less tall, values greater than zero make the left edge less tall. This feature only works when **Hardware Accelerated Rendering** is turned on in the Preferences.
- **layer (v1.1 + HAR)**: This value determines the order in which the images will be rendered when using multiple projectors in the same scene. Lower numbers are further away from you – i.e., the Projector with the highest layer value will be

seen “in front” of the other images. This feature only works when **Hardware Accelerated Rendering** is turned on in the Preferences.

- **active**: Determines whether or not the video stream is actually sent to the stage. When turned *on* new frames of video are sent to the Stage as they arrive. When turned *off* the frames of video are ignored. This means that the last frame of video received before this property was turned off will still be visible on the stage.
- **stage**: Specifies the stage upon which the video stream will be displayed.
- **render**: Determines the method by which the video stream will be rendered to the stage.

  NOTE: This input has no effect when **Hardware Accelerated Rendering** is turned on in the Preferences.

  There are four options available:

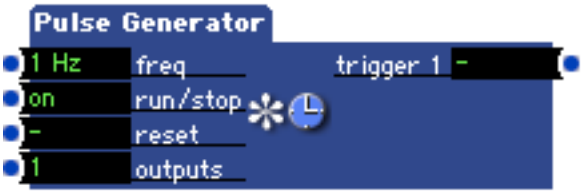
  auto (which is the default setting) does its best to determine the best rendering option from those available. It will generally default to **decom**.

  copy uses QuickTime’s CopyBits() function, which is slower than **decom** (description to follow) but does not have any delay due to initialization.

  decom uses a QuickTime ‘decompression sequence’ which is generally the fastest method, but does require a small amount of time to initialize when a new stream of video appears at the video in input. This initialization only becomes an issue if you are routing multiple streams of video to a single projector (e.g., using the Router actor) and switching between them frequently. If this is the case, it is best to use the **copy** or **direct** option.

  direct is the fastest method, but is only useful in specific situations. Namely, when using a Macintosh G4 computer, and when the stage height and width is exactly the same or exactly double the height and width of the video being rendered. If you chose the **direct** option and these conditions are not met, then the **copy** will be used instead.

Pulse Generator



Generates triggers that are evenly spaced in time.

The Pulse Generator will send a trigger out of its trigger output at the frequency specified by the freq input property. You can optionally specify more than one output. If you do so, the outputs will send triggers in sequentially, one after the other.

Input Properties

- **freq**: The frequency at which the triggers will be sent, from .0001 to 999 Hz (cycles per second.)
- **run/stop**: When set to *on*, the pulse generator runs normally. When set to *off* the pulse generator is paused. It will continue counting time at the point it left when the run/stop property is turned back on.
- **reset**: Resets the Pulse Generator's internal time counter to 0. This means that it will be at least one full cycle before the next trigger is sent.
- **outputs**: sets the number of output triggers on the right side of the actor. When this value is greater than 1, each output will send a trigger, one after the other (i.e., trigger 1, then trigger 2, etc.,) until the last output is triggered. Then the process begins again with trigger 1.

  When using multiple outputs, the actual frequency at a given output will be less than that specified by the freq input – each will pulse at a frequency of freq divided by outputs (E.g., with freq set to 1 Hz and outputs set to 3, each output will pulse at a rate of 1 Hz divided by 3, or 0.3333 Hz.)

  This feature is most useful when you want to trigger other Actors alternately or sequentially.

Output Properties

- **trigger 1, trigger 2, etc**.: Sends a trigger at a rate determined by the freq input property. If there is more than one output, each will be triggered sequentially, one after the other.

Random

Generates random numbers.

Input Properties

- **trigger**: Sends a new random number out of the value out property each time a trigger is received.

Output Properties

- **value out**: Outputs a new random number each time the trigger input receives a trigger.

Real Time Watcher (v1.1)

Looks for MIDI Real Time Messages on the specified port.

Input Properties

- **port**: Specifies the MIDI Port on which the message must arrive to be seen. These port numbers correspond to the ports shown in the MIDI Setup dialog. You may specify a single port or a range of ports.
- **message**: Specifies the MIDI Real Time message that will trigger this actor. Can be one of the following: timing, start, continue, stop, or reset.

Output Properties

- **trigger**: Sends a trigger when the message specified by the message input arrives on the specified MIDI port.

Recall Snapshot

Recalls a snapshot when triggered.

Input Properties

- **trigger**: Recalls the snapshot specified by the snapshot property when a trigger is received on this input.
- **snapshot**: The snapshot to recall when a trigger is received at the trigger input. If this snapshot exists, it is recalled. If it doesn't exist, nothing happens.

  NOTE: This property is *not* restored when a snapshot is recalled. This would change the value in this property when the actor recalled a snapshot, which ends up being quite confusing.

Resizable Bkg

Generates a video stream with a solid color at a specific horizontal and vertical resolution.

The Background Color actor generates a solid color video stream at the default resolution specified by in the Video Tab of the Preferences. This actor allows you to generate a video stream of any resolution.

Input Properties

- **bkg color**: This determines the color of the output video stream. There are two ways to specify the color: first, if you click on the colored square to the left of the title bkg color, a standard color picker dialog will appear. Or, you may connect the output of the Color Maker actor to the bkg color input.
- **horz size**: The horizontal output resolution in pixels.
- **vert size**: The vertical output resolution in pixels.
- **force 4:3:** When this parameter is on, changing the value of either the horz or vert size input will automatically adjust the other input so that the ratio between horizontal and vertical is 4:3.

Output Properties

- **video out**: Outputs a solid color video stream at the specified resolution.

RGB to YUV (v1.1)

Converts a video stream from RGB to YUV.

This actor is used to explicitly convert an RGB video stream to YUV, usually to be fed to a video-processing actor that prefers RGB.

If the incoming stream is already YUV, then it is passed directly to the output.

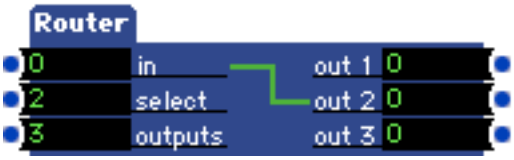
See “YUV Video Processing” on page 130 for more information about using YUV mode in Isadora.

Input Properties

- **video in**: The RGB video stream to be converted to YUV.

  video out: The input video stream, converted to YUV format.

Router



Routes data from a single input to one of several outputs.

The Router actor routes any type of data (numbers, video, sound, etc.) from the input to one of several outputs. You specify the number of outputs by setting the outputs input property to the desired number of outputs. Once this is done, you can select the output to which the data will be sent by changing the select input. Setting this property to 1 sends the data to out 1, setting it to 2 sends the data to out 2, etc.

Note that the in input and out outputs this actor are mutable. This means they will *all* change their type (integer, float, video, etc.) to match the first link made to one of these properties. Once a link has been made to any of the mutable properties, their types will remain fixed, based on that first connection, until all have been disconnected. Then the properties become mutable again.

Router can be especially useful when you want to feed video streams to multiple effects. Typically, you would connect a video effect Actor to each output, and then connect all of their outputs to a Projector Actor. Since data only goes to one effect at a time, only one of the effects is actually processing video at any given moment, saving on processing power. And, because only one video effect at a time outputs video, this means that you can connect all of the effects' outputs to a single Projector without worrying output seeing interspersed frames of video on the stage.

Input Properties

- **in**: Receives the data to be routed to one of the outputs.
- **select**: Chooses the output to which data arriving at the in input will be routed.
- **outputs**: Specifies the number of outputs. Increasing this number adds more outputs, reducing it removes outputs.

Output Properties

- **out 1, out 2, …**: The number of outputs is specified by the outputs input property. Data from the in input will be routed to the output number specified by the select input property.

Scale Value

Multiplies the input value by a specified percentage, limiting the output to a range of 0 to 100.

Input Properties

- **value**: The input value.
- **scale%**: The percentage by which the input value will be multiplied, from –1000 to +1000 percent.

Output Properties

- **output**: The scaled output value.

Scaler (v1.1)

Scales a video stream to an arbitrary resolution.

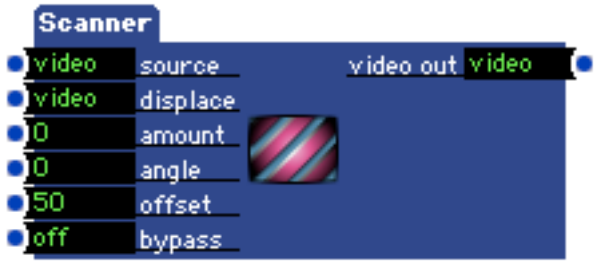
Input Properties

- **vide**: The incoming video stream.
- **horz size**: The horizontal output resolution in pixels.
- **vert size**: The vertical output resolution in pixels.
- **force 4:3:** When this parameter is on, changing the value of either the horz or vert size input will automatically adjust the other input so that the ratio between horizontal and vertical is 4:3.

Output Properties

- **output**: The video stream scaled to the specified horizontal and video resolution.

Scanner



Offsets the pixels of a video stream based on the brightness of a second video stream.

Displace shifts the pixels the source video stream using the brightness of the displace stream to determine how far to move the pixels. For example, assuming the displace angle is zero, when the displace video is gray (i.e., 50% brightness) the pixels of the source are not moved at all; as it approaches black the source video pixels are shifted more to the left; as it approaches white, the source video pixels are shifted more to the right.

One useful technique is feed the same video into the both the source and offset video inputs. This results in three-dimensional effect that harkens back to some nice analog video synthesizers of the past.

Source & Displace Video

Output

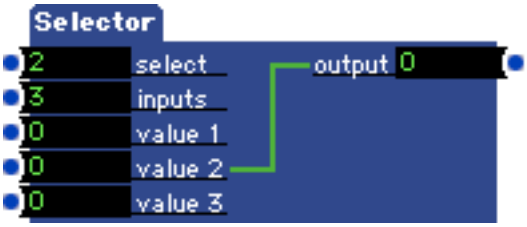
Input Properties

- **source video**: The video input stream
- **displace**: Video stream whose brightness determines how far to shift the pixels of the source video.
- **amount:** The strength of the displace effect, from 0 to 100%. The higher the value, the more profoundly the pixels of the source video will be shifted.
- **displace angle:** Sets the angle of the line along which the pixels are shifted.
- **offset:** How far to offset the resulting image, from 0 to 100%. If the displace video stream is too bright or too dark, the resulting video may go off the edge of the stage. Adjust this value to bring the image back into view again.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **video out:** The resulting displaced video output.

Selector



Routes multiple inputs of any type to one output.

The Select or actor will route data from one of several inputs to an output. When a particular value input is selected with the select parameter, any values that arrive on that input will immediately be sent to output. In addition, whenever the select input changes and a new input is routed to the output, the current value of the newly selected input is sent to the output.

Note that the value inputs and output of this actor are mutable. This means they will *all* change their type (integer, float, video, etc.) to match the first link made to one of these properties. Once a link has been made to any of the mutable properties, their types will remain fixed, based on that first connection, until all have been disconnected. Then the properties become mutable again.

This module is especially useful when you want to route multiple video outputs to one input.

Input Properties

- **select**: Chooses which input will be routed to the output. This value can range between 1 and the number of inputs specified by the inputs property.
- **inputs**: The number of value inputs available to be routed to the output.
- **value 1, value 2, etc.**: The value inputs that will be routed to the output.

Output Properties

- **output**: Passes on any value arriving at the input to the output specified by the select input property.

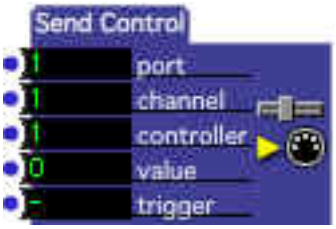
Send Bank Select

Sends a MIDI Bank Select message each time a trigger is received.

Input Properties

- **port**: The MIDI port on which the message will be sent. These port numbers correspond to the Destinations shown in the MIDI Setup dialog.
- **channel**: The MIDI Channel on which the message will be sent.
- **bank**: The MIDI bank number, from 0 to 127.
- **program**: The MIDI program change number, from 0 to 127.
- **trigger**: Sends a MIDI Bank Select message with the values specified by the other input properties each time a trigger is received on this input.

Send Control



Sends a MIDI Control Change message each time a trigger is received.

Input Properties

- **port**: The MIDI port on which the message will be sent. These port numbers correspond to the Destinations shown in the MIDI Setup dialog.
- **channel**: The MIDI Channel on which the message will be sent.
- **controller**: The MIDI controller number, from 0 to 127.
- **value**: The MIDI controller value, from 0 to 127.
- **trigger**: Sends a MIDI Control Change message with the values specified by the other input properties each time a trigger is received on this input.

Send NonReg Param

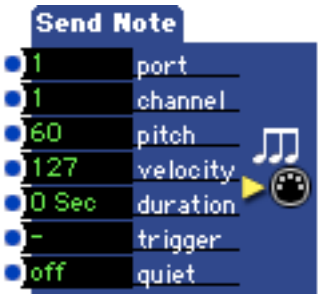
Sends a MIDI Non-Registered Parameter Change message each time a trigger is received.

According to the MIDI specification, a non-registered parameter value can range form 0 to 16383. Sometimes this is not the most useful representation when sending certain parameters to synthesizers and other MIDI gear, especially when the value is interpreted as a bipolar (+ and -) number. To address this issue, the Send NonReg Param actor has a **mode** property that allows you to map input values to the 0 to 16383 range in a several ways. A detailed description of the four modes can be found below.

Input Properties

- **mode**: The mode that determines how the parameter value will be specified, which can be one of the following:
  - *norm:* The parameter value ranges between 0 and 100. In this mode the range of input value is scaled to the actual MIDI range of 0 to 16383. 0 yields 0, 50 yields 8192, 100 yields 16383.
  - *norm +/-* The parameter value ranges between –50 and +50. In this mode, the range of input value is scaled to the actual MIDI range of 0 to 16383. –50 yields 0, 0 yields 8192, and +50 yields 16383.
  - *direct* The parameter value ranges between 0 and 16383. This matches the actual MIDI range, so no scaling is necessary.
  - *direct +/-* The parameter value ranges between –8192 and 8191. In this mode, the input value is scaled to the actual MIDI range of 0 to 16383 by adding 8192. –8192 yields 0, 0 yields 8192, +8191 yields 16383.
- **port**: The MIDI port on which the message will be sent. These port numbers correspond to the Destinations shown in the MIDI Setup dialog.
- **channel**: The MIDI Channel on which the message will be sent.
- **param #**: The MIDI parameter number, from 0 to 16383.
- **value**: The MIDI parameter value. The range of values depends on the setting of the **mode** property.
- **trigger**: Sends a MIDI Non-Registered Parameter message with the values specified by the other input properties each time a trigger is received on this input.

Send Note



Sends a MIDI Note On message each time a trigger is received, optionally sending a MIDI Note Off message after a specified amount of time has elapsed.

Input Properties

- **port**: The MIDI port on which the message will be sent. These port numbers correspond to the Destinations shown in the MIDI Setup dialog.
- **channel**: The MIDI Channel on which the message will be sent.
- **pitch**: The Note On message's pitch, from 0 to 127 or C-2 to G8. (You can choose to see the pitches using their note names by clicking on the title pitch next to the value edit box and choosing **Display > MIDI Note**.)
- **velocity**: The Note On message's velocity, from 1 to 127. (Per the MIDI Specification, a Note On message with a velocity of 0 is a Note Off message.)
- **duration**: The amount of time to wait before a Note Off message corresponding to the previously sent Note On is sent. If this value is set to 0, then no Note Off message will be sent.
- **trigger**: Sends a MIDI Note On message with the values specified by the other input properties each time a trigger is received on this input. If the duration property is greater than zero, then a corresponding Note Off message will be sent after that duration has elapsed.
- **quiet**: When turned on, silences any previously sounding note before a new note on message is sent. This is useful when you want to make sure that notes don't overlap regardless of the speed with which this actor is triggered.

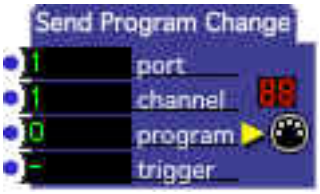
Send Pitch Bend

Sends a MIDI Pitch Bend message each time a trigger is received.

Input Properties

- **port**: The MIDI port on which the message will be sent. These port numbers correspond to the Destinations shown in the MIDI Setup dialog.
- **channel**: The MIDI Channel on which the message will be sent.
- **bend value**: The Pitch Bend message's bend value, from 0 to 16383.
- **trigger**: Sends a MIDI Pitch Bend message with the values specified by the other input properties each time a trigger is received on this input.

Send Program Change

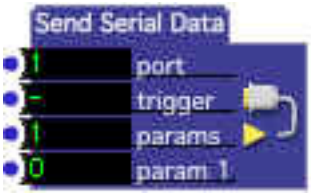


Sends a MIDI Program Change message each time a trigger is received.

Input Properties

- **port**: The MIDI port on which the message will be sent. These port numbers correspond to the Destinations shown in the MIDI Setup dialog.
- **channel**: The MIDI Channel on which the message will be sent.
- **program**: The Program Change message's program number, from 0 to 16383.
- **trigger**: Sends a MIDI Pitch Bend message with the values specified by the other input properties each time a trigger is received on this input.

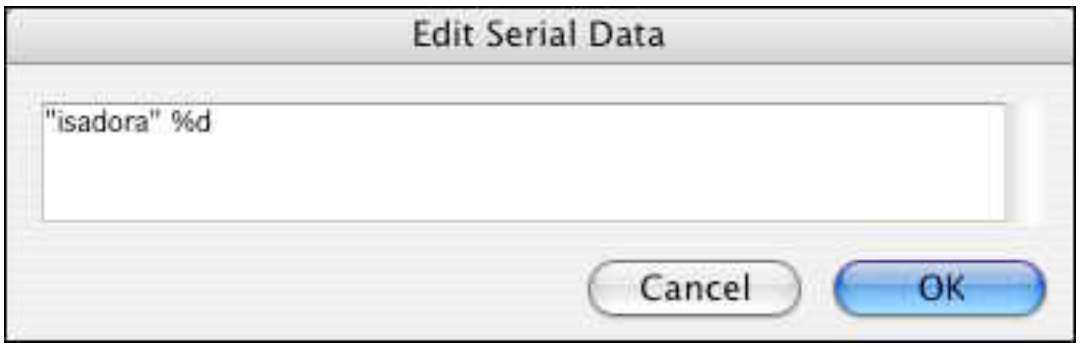
Send Serial Data (v1.1)



Sends data to the currently specified serial output port.

For more information on setting up serial communications, see "Serial Output" on page 139 in the Isadora Reference section.

To edit the message, double-click this actor's icon. A dialog will appear in which you can specify the serial data to be sent:



To edit the data that will be sent, double click the Send Serial Data actor; a dialog will appear that allows you to edit the text. Normally the editor expects a list of hexadecimal numbers, e.g., 01 2F 37....

To send ASCII text, you must enclose the text in double-quotes, i.e., to send the word **hello** you would enter "**hello"**. When specifying ASCII text, you can send various control characters by using one of the special "escape" sequences shown below.

\a	0x07 (Bell)
\b	0x08 (Backspace)
\f	0x0C (Form Feed)
\n	0x0A (New Line)
\r	0x0D (Carriage Return)
\t	0x09 (Tab)
\\	Backslash
\"	Double-quote
\0	0x00 (Null)

Note that to include a double-quote or a backslash inside of ASCII text, you must precede it with a backslash as well.

To send the value of one of the input parameters, you use P1 – P9 in place of a pair of hexadecimal digits, where P1 is Parameter 1, P2 is Parameter 2, etc. Note that the value of the variable parameters are sent out as one byte, so if parameter 1 has the value 0, then the byte sent will be 0, not the ASCII character '0' (which is decimal 48).

Some examples:

0E 11 C0 –!sends the three hexadecimal bytes, 0E 11 C0, which are decimal 14, 17 and 192 respectively.

"pl\r" – sends the characters 'p' and 'l' followed by a carriage return (hex 0D, decimal 13)

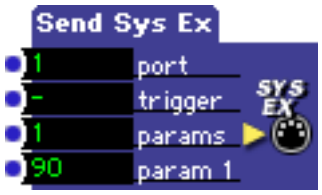
05 "hello" 0A 0D – sends eight bytes, starting with 5, then the characters 'h', 'e', 'l', 'l', 'o', followed by hex 0A and 0D (which are 10 and 13 in decimal.)

FF “?” P1 P2 – sends four bytes, starting with hexadecimal FF (255 decimal) followed by the character “?”, and ending with two bytes that give the value of Param 1 and Param 2 respectively.

Input Properties

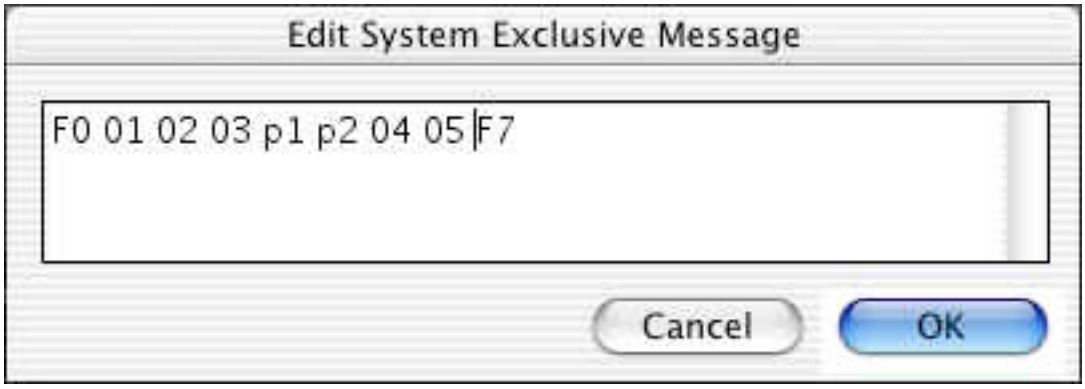
- **port**: Specifies the serial port to which the data will be sent. This port is configured using the Serial Port Setup dialog found in the Output menu.
- **trigger**: When a trigger is received on this port, the data is sent to the specified serial output port.
- **params**: The number of variable parameter inputs. Increasing this number adds parameter inputs, decreasing it removes them.
- **param 1, param 2, etc:** variable value parameters that will be inserted into the serial data . See description above for more about using variable parameters.

Send Sys Ex



Sends a MIDI System Exclusive message each time a trigger is received.

To edit the message, double-click this actor's icon. A dialog where you can specify the System Exclusive message will appear:



Messages must be entered in hexadecimal, starting with a hex F0 (start of exclusive) and ending with hex F7 (end of exclusive).

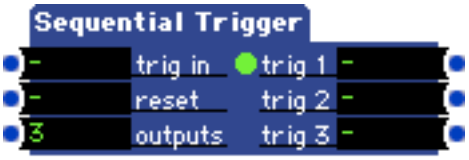
You can also insert variable values in the message by using the codes P1 – P9 instead of a valid hexadecimal number. After you do this, you should set then params input to the desired number of variable parameters, and the specified number of parameter value inputs will appear: param 1, param 2, etc. When a

message is sent, the codes P1 – P9 will be replaced with the current value of the matching parameter inputs (i.e., “P2” in the message is replaced by the value of the param 2 input).

Input Properties

- **port**: The MIDI port on which the message will be sent. These port numbers correspond to the Destinations shown in the MIDI Setup dialog.
- **trigger**: Sends a MIDI System Exclusive message each time a trigger is received on this input.
- **params**: The number of variable parameter inputs. Increasing this number adds parameter inputs, decreasing it removes them.
- **param 1, param 2, etc:** variable value parameters that will be inserted into the System Exclusive message. See description above for more about using variable parameters.

Sequential Trigger



Sends triggers out of multiple outputs sequentially.

Input Properties

- **trig in**: Sends a trigger to the next trigger output. The first trigger that is received after the actor is activated will be sent to the trig 1 output. Each subsequent input trigger will send a trigger out of the next available output. When the last output has been triggered, the sequence starts over at the beginning.
- **reset**: Resets the sequence over so that the next trigger received at the trig in input will send a trigger to the trig 1 output.
- **outputs**: determines the number of trigger outputs. Setting this value to a higher number will add more trigger outputs to the actor, setting it lower will remove trigger outputs.

Output Properties

- **trig 1, trig 2, etc**.: The output triggers.

Shapes

Superimposes ovals or rectangles of a specified color, size, and position on a video stream.

Input Properties

- **rgb in**: The source video stream on which the shapes will be superimposed. If you leave this input disconnected, the shapes will be drawn on a black background. If this stream is in YUV format, it will automatically be converted to RGB.
- **horz pos**: The horizontal center of the shape, specified as a percentage of the stage width from –200 to 200. A horizontal position of zero is halfway between the left and right edge.
- **vert pos**: The vertical center of the shape, specified as a percentage of the stage height from –200 to 200. A vertical position of zero is halfway between the top and bottom edge.
- **width**: The width of the shape, specified as a percentage of the stage width from 0 to 200.
- **height**: The height the shape, specified as a percentage of the stage height from 0 to 200.
- **line size**: The size of the shape's frame, expressed as a percentage of the stage width from 0 to 50.
- **fill color**: The color of the shape.
- **line color**: The color of the shape's frame.
- **shape**: The shape that will be drawn, either rectangle or oval.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **rgb out**: The shape superimposed at on the input video stream in RGB format.

Shimmer

Creates a shimmer effect by randomly choosing pixels from previous frames.

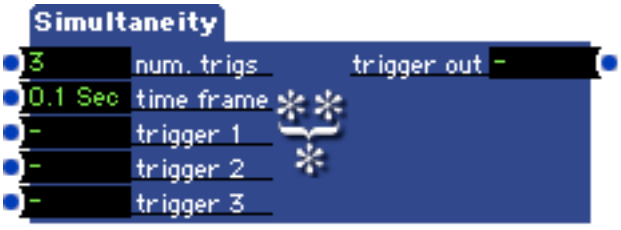
Input Properties

- **video in**: The source video stream that will be affected.
- **frames**: The maximum frames of video will be used to create the shimmer effect –!note that the actual number of frames depends on the setting of the amount input (see below.) Note that each frame requires a fair amount of memory, so setting this value to a high number will consume considerable free memory.
- **amount (v1.1)**: Specifies how many frames of video will actually be used to created the shimmer effect, specified as a percentage of the total available frames show in the frames input.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **video out**: The shimmered video stream.

Simultaneity



Sends a trigger when triggers from multiple inputs are all received within a specified amount of time.

Often it is useful to trigger an action when multiple things happen “at once.” The Simultaneity actor allows you to do this by sending a trigger if any only if a trigger is received on all of its trigger inputs within a specified amount of time. By adjusting the time frame property you can control how close the triggers must be before a trigger is generated at the output.

Input Properties

- **num trigs**: The number of triggers that this actor will be looking for.
- **time frame**: The time frame within which all of the triggers must be received before a trigger will be sent out of the trigger out output.
- **trigger 1, trigger 2, etc.**: The trigger inputs.

Output Properties

- **trigger out**: Sends a trigger when all of the trigger inputs have been triggered within the amount of time specified by the time frame input property.

Slit Scan

Scrolls one line or column of the source video from a vertical or horizontal center point, creating an effect reminiscent of Doug Trumbull's classic seen at the end of *2001: A Space Odyssey*.

This actor produces particularly interesting output when the source video stream has an object or objects that move somewhat slowly through the frame. (Try it with your face…)

Input Properties

- **video in**: The source video stream.
- **center**: The center point from which the video will scroll outward (when mode is horizontal) or upward and downward (when mode is vertical), from 0% to 100%
- **mode.**: When set to *horiz*, the video scrolls out horizontally from the center point. When set to *vert*, the video scrolls vertically from the center point.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **video out**: The Slit Scanned video stream.

Smoother (v1.1)

Smoothes out noisy numeric values.

Sometimes when receiving a continuous stream of numeric values from an external sensor, the values will be noisy for one reason or another. Smoother addresses this problem by smoothing out the incoming values.

This actor is similar to the Filter actor, but uses a much better algorithm. In general, you should use the Smoother actor now instead of the Filter actor.

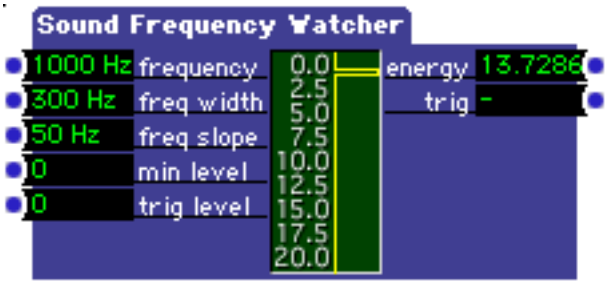
Input Properties

- **value in**: The numeric values to be smoothed.
- **smoothing**: The amount of smoothing, from 0 to 1. A value of 0 produces no smoothing at all, while a value of .99 produces extremely smooth output. Note however, that the higher this setting, the more the output values will lag behind the input value.
- **frequency.**: Determines how often a value is sent of the value out output. This is specified in Hertz, i.e., cycles per second. The higher the frequency, the smoother the resolution at the output. Note, however, that if you are processing a lot of video and getting slow frame rates, the actually frequency may be lower than the value specified here.
- **force out**: When turned off, values are only sent out of the value out output when they change. When turned on, values are sent out at the rate specified in the frequency input, regardless of whether they have changed or not.

Output Properties

- **value out**: The smoothed values.

Sound Frequency Watcher



Measures the audio intensity of a specific frequency band arriving at via the Sound Capture input.

The sound level watcher allows you to manipulate parameters in relationship to the frequency content of the audio signal arriving at the Sound Capture input.

To use this actor, you must first enable Audio Capture by choosing **Input > Start Video + Sound Input** or **Input > Start Audio Capture** and you must ensure the **Sound Frequency Analysis** item in the **Capture** menu is checked. See the section "Enabling Live Video & Audio Input" on Page 144 for more information on setting up live audio input.

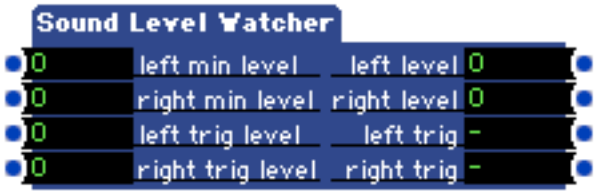
To use this actor, you must start by specifying the frequency band to be "watched" by setting the frequency and frequency width inputs (also known as the "pass band.") All frequencies between frequency – frequency width and frequency + frequency width will be seen by this watcher. The final parameter is the slope input. This adds in more energy above and below the specified pass band, but with less influence as the frequency extends beyond the pass band. Once you have specified these parameters, the watcher will start reporting the total audio "energy" within the specified band. To help you visualize what frequencies the actor will "see", a graph of the current pass band is drawn in the center of the actor.

The min level input property sets the level above which the Sound Frequency Watcher will "see" the audio input. Whenever the level is above min level values, the energy values will be sent to the energy output. You can use the energy output as continuous control input to other actors.

Note that when you set the min level property to a value greater than zero, the value at the output is scaled so that as the input level varies between the minimum level and 100, the output will vary between 0 and 100. E.g., if you set the minimum to 50, and the incoming audio level is 66.7 (one-third of the way between 50 and 100) the output value will be 33.4 (one-third of the way between 0 and 100).

The trig level input property determines when the trig output will send a trigger. Each time the output level goes above these minimums, a trigger will be sent out of the trig output. This allows you to trigger events based on the energy of the sound at the specified frequency.

Sound Level Watcher



Watches for changes in the level (amplitude) of the live audio input and converts those levels into values that can be used to control other actors.

The Sound Level Watcher allows you to use the control other actors based on the amplitude of a live audio signal.

To use this actor, you must first enable Audio Capture by choosing **Input > Start Video + Sound Input** or **Input > Start Audio Capture**. See the section entitled "Enabling Live Video & Audio Input" on Page 144 for more information on setting up live audio input.

To use this actor, start by setting the left min level and right min level input properties. These set the levels above, which the Sound Level Watcher will "see", the audio input. Whenever the level is above the left min level or right min level values, values will be sent to the left level or right level outputs, respectively. You can use the left level and right level outputs as continuous control inputs to other actors.

Note that when you set the left min level and right min level properties to a value greater than zero, the value at the output is scaled so that as the input level varies between the minimum level and 100, the output will vary between 0 and 100. E.g., if you set the minimum to 50, and the incoming audio level is 66.7 (one-third of the way between 50 and 100) the output value will be 33.4 (one-third of the way between 0 and 100).

The left trig level and right trig level input properties also determine when the left trig and right trig outputs will send a trigger. Each time the output level goes above these minimums, a trigger will be sent out of the corresponding output. This allows you to trigger events based on the volume of the sound.

Input Properties

- **left min level**: The level that must be exceeded before the left volume level will be sent to the left output, from 0 to 100 percent.
- **right min level**: The level that must be exceeded before the right volume level will be sent to the left output, from 0 to 100 percent.
- **left trig level**: Whenever the left output level goes above this value, a trigger will be sent out of the left trig output.
- **right trig level**: Whenever the right output level goes above this value, a trigger will be sent out of the right trig output.

Output Properties

- **left level**: Sends the current volume level of the left sound input channel, from 0 to 100 percent. This output will change only when the level is above the value specified in the left min input property. Note that, if the left min level is greater than 0, this value is scaled – see above for details.
- **right level**: Sends the current volume level of the right sound input channel, from 0 to 100 percent. This output will change only when the level is above the value

specified in the right min input property. Note that, if the right min level is greater than 0, this value is scaled – see above for details.

- **left trig**: Sends a trigger whenever the left volume level goes above the left trig level.
- **right trig**: Sends a trigger whenever the right volume level goes above the right trig level.

Sound Movie Player

Plays a QuickTime movie with multiple sound tracks, allowing you to control the volume, panning, and output routing of each track individually.

QuickTime Movies can have multiple tracks of sound embedded in each movie. The Sound Movie Player actor allows you to manipulate the volume and panning of each of these tracks individually, and to route each sound track to a separate output on a multi-channel output device if desired. (To find out how to create a multi-channel audio movie, see “Creating a Multi-Channel Audio Movie Using QuickTime Player Pro” on page 148.

The play start and play length parameters specify what portion of the movie will play. See Movie Player actor for a detailed explanation of these inputs.

This actor is useful for multi-channel sound installations or performances that require interactive control over multiple tracks of sound.

Input Properties

- **movie**: The number of the movie you want to play, as shown in the Media Window. When the number of a valid movie is entered here, its name will appear

to the right of the number. Note that it is possible to choose a movie that also contains video, but you will not be able to access the video from this movie.

- **on/off**: When turned *on* the movie plays and the resulting video stream is sent out of the video out output. When turned *off*, the movie stops playing and is unloaded from memory.
- **speed**: The speed of the movie, from –10 to 10 times normal speed. The default setting is 1.0, which plays the movie forward at normal speed. 0.5 would play the movie forward at half speed. A setting of 2.0 plays the movie forward at twice normal speed. Negative values play the movie in reverse.
- **position**: Whenever a value arrives at this input, the Sound Player jumps to the specified position *within the play segment*. (The play segment is defined by the play start and play length properties – see below.) This parameter is expressed as a percentage of the play length, from 0 to 100.
- **play start**: Determines the starting point of the play segment (the portion of the movie that will play) as a percentage of the movie's total length, ranging from 0 to 100.
- **play length**: Determines the length of the play segment (the portion of the movie that will play) as a percentage of the movie's total length, ranging from 0 to 100.
- **loop enable**: If this property is turned off, the play segment will play once each time the Sound Movie Player's Scene is activated, or when its on/off property is turned on. If this property is on, once the movie starts playing it will continue by looping back to the start of the play segment when the end of that segment is reached.
- **preload**: When this input is triggered, the movie's sound data is "prerolled" so that you can achieve an instantaneous start when turning the on/off property on. Note that the on/off property must be off for preload to work. If the movie is playing, triggering this input has no effect.
- **mstr volume**: Sets the master volume for all audio tracks in the movie being played by this actor.
- **track count**: Specifies the number of tracks in the QuickTime movie. When you increase this value, the actor will add a volume, pan, and sound output input for each track

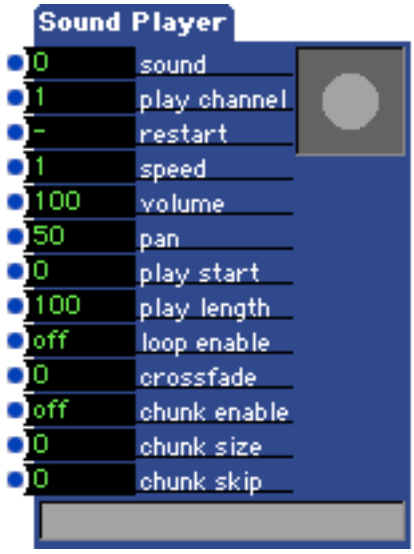
  Note: you can find out the number of tracks in a movie by looking at the Media Window. If a movie has more than one sound track, you see (ST=x) after the name, where x is the number of sound tracks in the movie.
- **trk vol 1, trk vol 2, etc.**: Sets the volume of one of the Movie's sound tracks, expressed as a percentage of the sound track's normal volume from 0 to 200%. trk vol 1 sets the volume for track 1, trk vol 2 sets the volume for track 2, etc. A setting of 100% is normal volume, 0 produces silence, and 200 would amplify the sound to twice its normal level. Note that using values above 100 may produce distortion.
- **trk pan 1, trk pan 2, etc.**: Sets the panning of one of the Movie's sound tracks, from 0 to 100. 0 is left, 100 is right, 50 is center. trk pan 1 sets the panning for track 1, trk pan 2 sets the panning for track 2, etc.

- **snd out 1, snd out 2, etc.**: The sound output routing for the specified track. std = built-in output, e1-2 = output on external sound device channels 1 and 2, e3-4 = output on external sound device channels 3 and 4, etc. snd out 1 sets the panning for track 1, snd out 2 sets the panning for track 2, etc.

  If no external device is present when the movie is played, or if that device does not have the requested channels, the sound will be sent to the built-in interface.

  See the section “Using External Multi-Channel Sound Output” on Page 144 for more information.

Sound Player



Plays a sound to the computer’s sound output, allowing control over its playback characteristics

There are four main things that you can control when manipulating the playback of a sound: its volume and panning, its speed, the portion of the sound that will play (and whether or not that portion will loop), and the channel on which it will play.

The portion of the sound that will play, is called the *play segment*. The play segment is determined by the play start and play length properties, both of which are expressed as a percentage of the sound’s total length. The play length indicates how long the play segment will be, while the play start specifies where that chunk will start. For example, with a sound that was 60 seconds long, a play start of 50% and a play length of 10% would indicate that the play segment would start 30 seconds into the sound and be 6 seconds long. You can choose to play this segment continuously by turning the loop enable property on.

The green bar at the bottom of the actor shows the play segment in bright green. The thin yellow line that moves across that bright green bar indicates the current sound position.

The play channel determines the sound channel on which the sound will play. At any given moment, only one sound can play on a given sound channel. This means that if you start playing one sound on a given channel and then play a different sound on the same channel, the second sound will interrupt playback of the first. To be able to hear two sounds play simultaneously, you must send them to different channels.

IMPORTANT: When a sound is being played and manipulated by the Sound Player, it is loaded entirely in your computer's Random Access Memory (RAM.) The Sound Player is not the best choice when playing extremely long sound clips as it may cause you to run out of RAM and they can take a long time to load. A better method of playing long sounds is to save the sound as a sound only QuickTime movie and use the Movie Player to play it. Even though there won't be any video sent out of the Movie Player's output port, you will still be able to control the volume, pan, and even the play segment. The disadvantage of using the Movie Player is that it doesn't loop short play segments very well.

Input Properties

- **sound**: The number of the sound you want to play, as shown in the Media Window. When the number of a valid sound is entered here, its name will appear to the right of the number.
- **play channel**: The channel on which the sound will be played, from 1 to 16. Note that to play two sounds simultaneously, they must be on different channels.
- **restart**: Starts playing the sound from the beginning of the play segment.
- **speed**: The speed of the movie, from –10 to 10 times normal speed. The default setting is 1.0, which plays the movie forward at normal speed. 0.5 would play the movie forward at half speed. 2.0 plays the movie forward at twice normal speed. Negative values play the movie in reverse.
- **volume**: Sets the volume of the Movie's sound track, if one is present. Expressed as a percentage of the sound track's normal volume.
- **pan**: Controls the panning of the sound, from 0 to 100. 0 is left, 100 is right, 50 is center.
- **play start**: Determines the starting point of the play segment (the portion of the movie that will play) as a percentage of the movie's total length, ranging from 0 to 100.
- **play length**: Determines the length of the play segment (the portion of the movie that will play) as a percentage of the movie's total length, ranging from 0 to 100.
- **loop enable**: If this property is turned *off*, the play segment will play once each time the Sound Player's Scene is activated, or when its restart property receives a trigger. If this property is turned *on*, once the sound starts playing it will continue by looping back to the start of the play segment when the end of that segment is reached.
- **crossfade**: When set to a value greater than zero, and when the loop enable property is turned on, crossfades the audio when looping from the end of the play segment to the beginning.) Often there is a noticeable click when looping. By

using a crossfade, the click can be reduced or even eliminated. This property is specified in audio samples. (At a sampling rate of 44100 Hz, a value of 4410 would be 1/10th of a second.

- **chunk enable**: Enables the "chunking" feature. When chunking is active, the sound player will play the number of samples specified by the chunk size property. Then, it will skip the number of samples specified by the chunk skip property, and start playing the next chunk. Depending on the settings of the size and skip properties, you will get sounds that vary from slightly distorted to heavily grunged out. (To start experimenting, try a size setting of 100, and a skip value of –50. Then gradually decrease the skip value, heading towards -99.)
- **chunk size**: The size of the chunk in samples.
- **chunk skip**: The number of samples to skip upon reaching the end of the chunk.

Sound Preload

Preloads a sound or range of sounds into memory so that the Sound Player can start playback instantly.

Sounds played by the sound player are loaded into your computer's Random Access Memory (RAM) so that they can be efficiently manipulated. This is fine, except that when using the Sound Player to play a particularly long sound, there can be a noticeable delay from the time you trigger the restart property until you hear the sound. This is usually because of the time it takes to read the sound into RAM from disk.

The Sound Preload actor allows you to avoid this delay by loading sounds into RAM in anticipation of their later playback.

Input Properties

- **preload**: Preloads the specified sound when a trigger is received.
- **mode**: This property can be set to either *play* or *forever*.

  When set to *play*, the sound is kept in memory until a Sound Player actor starts and then stops playing it. Once that actor stops playing the sound, it is removed from memory.

  When set to *forever*, the sound is kept in memory until it is preloaded again with the mode set to play, or until Isadora quits. Use this option with caution! It is easy to fill up your RAM with sounds that you no longer need to play.

- **sound low**: The number of the first sound you want to preload, as shown in the Media Window. If you want to preload only one sound, set the number of the sound you want to preload and leave the sound high input set to 0. Otherwise, to specify a range of sounds to preload, set this to the number of the first sound you want to preload and the sound high input to the last sound. When the number of a valid sound is entered here, its name will appear to the right of the number.
- **sound high**: The last sound in a range of sounds you want to preload. Use this in conjunction with the sound low input to specify a range of sounds to be loaded when a trigger is received at the preload input.

Spinner

Rotates the incoming video stream around a moveable center point, optionally zooming it in the process.

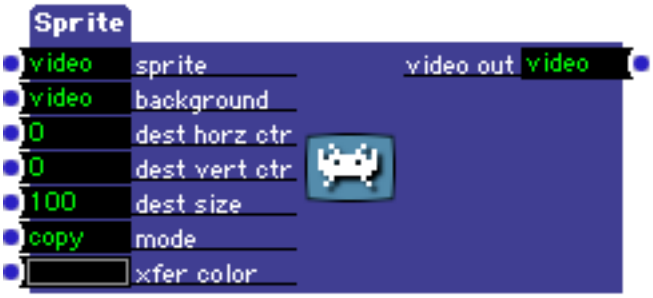
Input Properties

- **video in**: The source video stream.
- **angle**: The angle by which the source video stream will be rotated, specified in degrees from –720 to +720. Positive values rotate the image to the right, negative values to the left.
- **horz ctr**: The horizontal center point around which the source video stream will be rotated, from 0% to 100% of the source stream's width. To rotate the incoming video stream around its center, use 50.
- **vert ctr**: The vertical center point around which the source video stream will be rotated, from 0% to 100% of the source stream's width. To rotate the incoming video stream around its center, use 50.
- **zoom**: Sets the zoom factor for the incoming video stream, from 0 to 1000%. Setting this value to a number greater than 100 will make the image bigger, and so can prevent you from seeing the edge of the frame as the video image rotates.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **video out**: The rotated video stream.

Sprite



Overlays a video stream onto a background video stream, without scaling the "sprite" stream to match the size of the background, using a variety of transfer modes.

Normally, when an actor processes two video streams, they are scaled so that they match in size before they are combined. The Sprite actor does not scale the "sprite" video stream – it simply lays it on top of the background. This is similar to the setting Matte and Matte++ actor's scale fg input property to off.

The advantage of the Sprite actor over Matte and Matte++ is that there are several transfer modes available that determine how the sprite stream is rendered over the background.

Input Properties

- **sprite**: The source video stream that will be rendered on to the background stream.
- **background**: The video stream on to which the sprite will be rendered.
- **dst horz ctr**: Sets the horizontal center of the sprite within the background, from -100 to 100 percent of the background video's width. 0 is in the center of the image.
- **dst horz ctr**: Sets the vertical center of the sprite within the background, from -100 to 100 percent of the background video's height. 0 is in the center of the image.
- **dest size**: Allows you to scale the sprite, from 0 to 1000% of its original size. A value of 100 renders the sprite at its original size.
- **mode**: The transfer mode used to render the sprite on to the background image. The modes noted as being arithmetic (or, xor, bic) produce results that are somewhat unpredictable, but that can nevertheless prove interesting.

  The possible choices are:

  - **copy** – copies the image on top of the background.
  - **or** – performs a mathematical "or" operation on the color bits in the sprite and the background
  - **xor** – performs a mathematical "xor" operation on the color bits in the sprite and the background.

- **bic** – performs a mathematical “black is changed” operation on the color bits in the sprite and the background.
- **blend** – uses the brightness xfer color to blend the sprite and the background. The brighter this color, the more of the sprite you see. If you were to use the Color Maker actor to fade from white to black, the sprite would appear to “fade out”. Note that the transfer color works on the sprite colors individually –!a pure red xfer color would only allow you to see the red component of the sprite, with the green and blue being masked out.
- **transparent** – uses the brightness xfer color to matte the sprite on to the background. Wherever the sprite color exactly matches the xfer color, you will see the background. Where it does not match, you will see the sprite. (For those of you who have used transparent GIFs on web sites, the transparent mode is same concept.) Note that in compressed images, what appears to be a solid color is actually a slight variation on that color, and so won’t work well when attempting to use the transparent mode. To get best results, you should use an uncompressed picture with a solid color that you can match.
- **add over (add with overflow)**. Adds the colors of both streams together without limiting the result.
- **add max (add with limit maximum)**. Adds the colors of both streams together, limiting the sum to the maximum possible (255 for each color component).
- **sub over (subtract with overflow)**. Subtracts the colors of the second stream from the first without limiting the result.
- **sub min (subtract with limit minimum)**. Subtracts the colors of the second stream from the first, limiting the result to a minimum of zero.

- **xfer color**: See the blend and transparent modes for information on how this color is used.

Output Properties

- **video out**: The rotated video stream.

Stage Mouse Watcher

Outputs the current position of the mouse within one of Isadora's four stages, optionally choosing to see changes in position only when specific modifier keys are held down.

Input Properties

- **stage**: Specifies which stage the mouse must be over for this watcher to see mouse movements.
- **modifiers**: Specifies the modifier keys that must be held down before mouse movement will be seen by this watcher. Options include:

MacOS	Windows
cmd = d = command key	alt = a = alt key
ctl = c = control key	ctl = c = control key
opt = o = option key	win = w = windows key
shf = s = shift key	shf = s = shift key

  Note that when you save a file on MacOS and read it under Windows the **cmd** modifier becomes the **alt** modifier, and **opt** becomes **win**. The reverse is true when you move from Windows to MacOS.

  To enter a new set of modifiers, click on the modifiers value edit box and type the codes for modifiers you desire separated by hyphens. (You can use either the three letter or single letter modifiers when typing the new modifiers.) If you wanted the watcher to only see the mouse move when the option and command keys were down, enter opt-cmd and press *enter*.

  To remove all modifiers, click on the modifiers value edit box, press a space, and press *enter*.
- **limit horz.**: Limits the range of horizontal movement that this watcher will see, specified as a percentage of the width of the stage specified by the stage input property. For example, if you set this range to 0-50, the mouse will only be seen moving when it is in the left half of the stage.
- **limit vert.**: Limits the range of vertical movement that this watcher will see, specified as a percentage of the height of the stage specified by the stage input property. For example, if you set this range to 50-100, the mouse will only be seen moving when it is in bottom left half of the stage.

Output Properties

- **mouse down**: Sends a trigger when the mouse is clicked within the stage specified by the stage input property.
- **mouse up**: Sends a trigger when the mouse is released after it was initially clicked within the stage specified by the stage input property.
- **horz. pos**: The horizontal position of the mouse, ranging between 0% and 100%. This percentage is measured within the range specified in the limit horz input

property, not the entire width of the stage. So, if the limit horz property was set to 0-50, and the mouse was 25% of the way across the stage (i.e., halfway between 0% and 50%) then horz pos. output would be set to 50.

- **vert. pos**: The vertical position of the mouse, ranging between 0% and 100%. This percentage is measured within the range specified in the limit vert input property, not the entire height of the stage. So, if the limit vert property was set to 50-100, and the mouse was 75% of the way down the stage (i.e., halfway between 50% and 100%) then vert pos. output would be set to 50.
- **trigger**: Sends a trigger every time the horz. pos or vert. pos changes.

String (v1.1)

Allows you to send a string of arbitrary length to an actor with a string input.

To define the string that will be sent by this actor, double-click it. The Text Entry dialog will open, allowing you to type or paste as much text as you like into the actor.

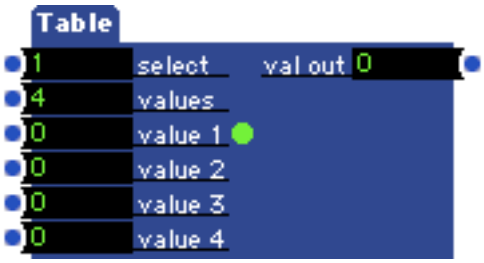
Input Properties

- **trigger**: Sends the string defined in the Text Entry dialog to the output.

Output Properties

- **out**: When a trigger is received at the input, sends the string defined in the Text Entry dialog to the output.

Table



Sends values, from a list of several inputs, to the output.

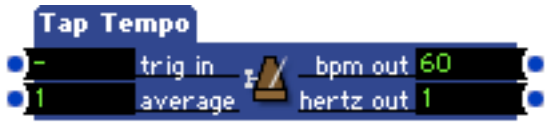
Input Properties

- **select**: Each time this value changes, the value at the corresponding input property (value 1, value 2, etc.) is sent to the output.
- **values**: Sets the number of values in the list. Increase this value to add input values, decrease it to remove input values.
- **value 1, value 2, etc**: Specifies values in the table. Each time that a new value is arrives to the select input, the corresponding input value (value 1, value 2, etc.) is sent to the value out output.

Output Properties

- **value out**: The value from the table as chosen by the select input.

Tap Tempo



Measures the tempo of incoming triggers.

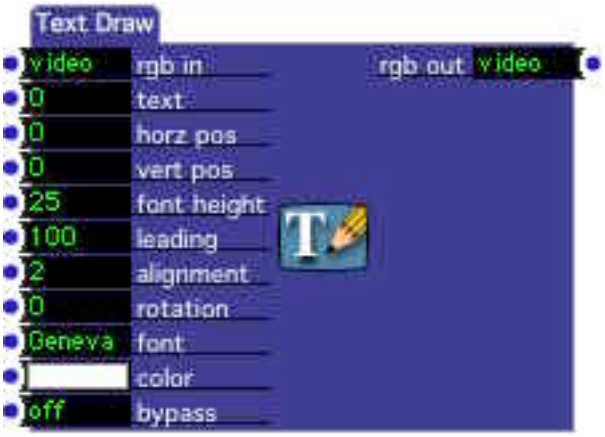
Input Properties

- **trig in**: Each time this input is triggered, the rate is calculated in Beats Per Minute (bpm) and Hertz (cycles per second) and sent to the corresponding outputs.
- **average**: Determines how many previous tempos will be averaged together. If this value is 1, then the reported tempo is calculated every time the trig in input is triggered. Higher values report the average tempo for the specified number of measurements, i.e., a value of 4 would average the tempo of the last four measurements.

Output Properties

- **bpm out**: The tempo in beats per minute.
- **hertz out**: The tempo in Hertz, or cycles per second.

Text Draw (v1.1)



Superimposes text on a video stream.

Draw Text allows you to superimpose a string received at the text input on a video stream, controlling its font, size, leading, alignment position and color.

Input Properties

- **rgb in**: The video stream on which the text will be superimposed. You can leave this input disconnected if you would like the text to appear on a black background. If this stream is in the YUV format, it will automatically be converted to RGB.
- **text**: The text to be display. This can be received from a String actor, or by linking this input to the Text Edit control.
- **horz pos**: The horizontal center of the text, specified as a percentage of the width of the frame, from –100 to 100 percent.
- **vert pos**: The vertical center of the text, specified as a percentage of the height of the frame, from –100 to 100 percent.
- **font height**: This is given as a percentage of the output stage height, from 0 to 1000. Theoretically, a value of 100 would produce text whose capital letters are the same height as the stage. In practice, because of the need for descenders (like the letter “j”) and other factors, the text won’t be quite as tall as the stage when set to 100.
- **leading**: The vertical spacing between lines of text
- **alignment**: One of the following: left, center or right.
- **rotation**: Rotates the text around its center point; specified in degrees, from –360 to +360.
- **font**: To set the font, click on this property’s value edit box; a menu with all of the fonts available on the system will appear. After choosing a font, its name will be displayed in the value edit box.
- **color**: The color with which the font will be drawn.

- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

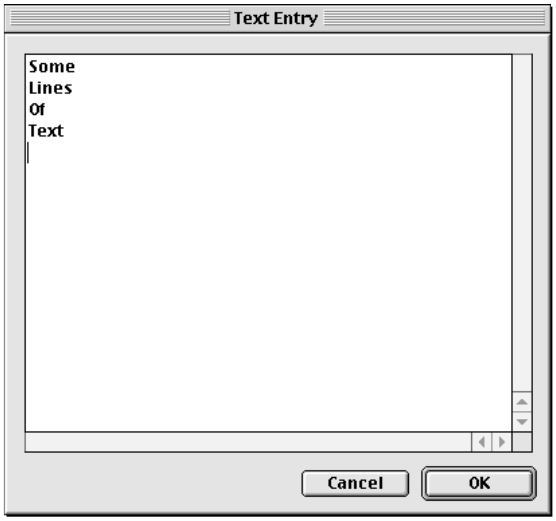
- **rgb out**: The text, drawn using the specified font, size, alignment, leading and color, superimposed upon the video stream connected to the video in port. Output in RGB format.

Text/ure

Superimposes text on a video stream.

Text/ure allows you to superimpose text on a video stream, controlling its font, size, position and color. In addition, you can choose to enter several lines of text and choose which line to show.

The first step is to enter the text you want to display. To do this, double-click the Text/ure actor. A window will appear that allows you to edit the text:



If you just want to show one word or phrase, type it and click OK. If you would like to have multiple words or phrases that you can choose on the fly, put them on

separate lines by hitting the Return key. In the example above, the four words Some, Lines, Of, Text will be able to be recalled individually using the line input.

Click OK when to confirm the new text.

Then, choose the font by clicking on the value edit box for the font property. A pop-up menu will appear that allows you to select the font from all of the fonts available on your computer.

After these steps are done, you can use the size input to set the size, position, and color of the font. The size is based on the height of the video frame; if you set it to 100%, the font will be as tall as the video output is high. The horizontal and vertical position inputs determine the position of the text within the frame. 0 is centered, negative numbers move the text to the left, positive numbers to the right. Finally, you can click on the value edit box for the color property to set the text color.

If you have entered multiple lines of text, you can select which line you will see by sending the number of that line to the line input. When you do, the text for the Text/ure actor will display that line.

Input Properties

- **rgb in**: The video stream on which the text will be superimposed. You can leave this input disconnected if you would like the text to appear on a black background. If this stream is in the YUV format, it will automatically be converted to RGB.
- **horz pos**: The horizontal center of the text, specified as a percentage of the width of the frame, from –100 to 100 percent.
- **vert pos**: The vertical center of the text, specified as a percentage of the height of the frame, from –100 to 100 percent.
- **font height**: This is given as a percentage of the output stage height, from 0 to 1000. Theoretically, a value of 100 would produce text whose capital letters are the same height as the stage. In practice, because of the need for descenders (like the letter “j”) and other factors, the text won’t be quite as tall as the stage when set to 100.
- **rotation**: Rotates the text around its center point; specified in degrees, from –360 to +360.
- **line**: If you have entered multiple lines of text (i.e., words or phrases followed by a carriage return) you can use this property to select which line of text will be shown.
- **font**: To set the font, click on this property’s value edit box; a menu with all of the fonts available on the system will appear. After choosing a font, its name will be displayed in the value edit box.
- **color**: The color with which the font will be drawn.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **rgb out**: The text, drawn using the specified font and color, superimposed upon the video stream connected to the video in port. Output in RGB format.

The Edge

Performs “edge detection” on a video stream, which results in light, colored lines wherever an edge between two objects is found.

The Edge works by looking at the source image, and detecting the areas on the image where there is an “edge”, that is a significant change in color or brightness. In the resulting image, the edges appear as bright colored lines, while other areas remain dark. See below for an example:

Before

After

Input Properties

- **rgb in**: The video input stream. If this stream is in the YUV format, it will automatically be converted to RGB.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **rgb out**: The edge-detected video output stream output in RGB format.

Threshold (v1.1)

Converts a video stream to a two-color image, with one color being used when the brightness is above a specified level, and the other color being used otherwise.

Before

After

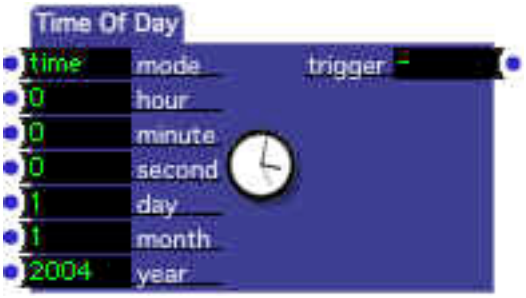
Input Properties

- **video in**: The video input stream.
- **threshold**: The threshold of brightness, from to 0 to 100%, that determines whether the bright color or dark color will be used when color the image. Portions of the video image whose brightness is above this value will be set to the bright color. Portions that are below this level will be set to the dark color.
- **bright color**: The color used to replace portions of the video stream that are above the threshold level.
- **drak color**: The color used to replace portions of the video stream that are below the threshold level.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **rgb out**: The edge-detected video output stream output in RGB format.

Time of Day (v1.1)



Sends a trigger at a specific time, at a specific time on a particular day, or at a periodic rate based on wall clock time.

Input Properties

- **mode**: When the mode is set to periodic, the hours, minutes and seconds specifies the frequency of the output trigger. When the mode is set to time, they specify a specific time of day when the trigger will be sent (i.e., once every 24 hours at the specified hour, minute and second.)

  If the mode is set to date/time, then the day, month, and year inputs will also be used allowing the user to specify a trigger that will occur on a particular date at a specific time (i.e., once in the history of the world.)
- **hour/minutes/second**: The time of day that will trigger this actor.
- **day/month/year**: The particular day on which the trigger will occur if the mode is set to date/time.

Output Properties

- **trigger**: Sends a trigger when at time of day matches that specified by the input properties.

Toggle

Toggles between on and off each time a trigger is received.

Input Properties

- **trigger**: The input trigger.

Output Properties

- **toggle out**: Changes from off to on, or from on to off each time a trigger is received..

Trigger Delay

Delays a trigger by the specified amount of time. Can also be used to determine if something hasn't happened for a period of time.

Upon receiving a trigger at the trig in input, the Trigger Delay actor will wait for a specified period of time before sending a trigger to the trig out output.

If an initial trigger is received at the trig in input, and then a second trigger is received before the delay has elapsed, the Trigger Delay actor starts counting time over at the second trigger. In other words, because incoming trigger resets the internal time counter, if the triggers come often enough, no trigger will be sent to the output. This can be useful when you want to find out when something *hasn't* happened for a period of time.

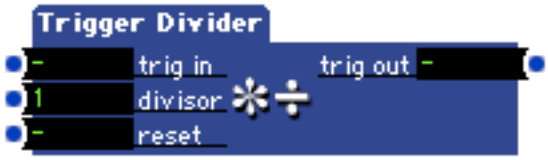
Input Properties

- **trig in**: The input trigger.
- **delay**: Upon receiving a trigger at the trig in input, the amount of time that will elapse before a trigger is sent to the trig out output.

Output Properties

- **trig out**: Sends a trigger after the specified delay has elapsed..

Trigger Divider



Sends one output trigger after a specified number of input triggers have been received.

Trigger Divider counts the number of triggers received at the trig in input. When the number of triggers received matches the value of the divisor input, then a trigger is sent to the trig out output, and the process begins again. This effectively divides the number of input triggers by the divisor value, i.e., if divisor is set to three, then an output trigger will be sent after every third input trigger.

Input Properties

- **trig in**: The input trigger.

- **divisor**: Determines how often a trigger will be sent to the output. Each time a trigger arrives at the trig in input, an internal counter is incremented by one. When this counter matches the value specified by the divisor input, a trigger is sent to the output.
- **reset**: starts the counting sequence over again.

Output Properties

- **trig out**: Sends a trigger after the specified number of triggers have been received at the trig in input.

Trigger String (v1.1)

Allows you to send a string of arbitrary length to an actor with a string input.

To define the string that will be sent by this actor, double-click it. The Text Entry dialog will open, allowing you to type or paste as much text as you like into the actor.

Input Properties

- **input**: The string to send to the output property each time a trigger is received at the trigger input.
- **trigger**: Sends the string to the output when a trigger is received.

Output Properties

- **output**: Sends the string shown at the value input each time the trigger input receives a trigger.

Trigger Value

Sends a value each time a trigger is received.

Input Properties

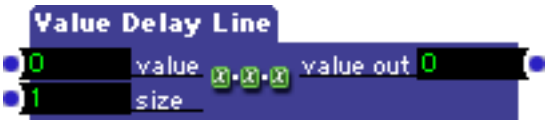
- **value**: The value to send to the value out property each time a trigger is received at the trigger input.

- **trigger**: Sends the value to the output when a trigger is received.

Output Properties

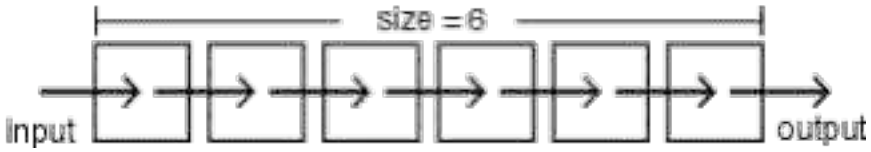
- **value out**: Sends the value shown at the value input each time the trigger input receives a trigger.

Value Delay Line



Delays a value by passing it through a specified number of stages.

You can imagine the delay line as a series of numbers in a pipe. Each time a new value arrives, the number at the end of the pipe is sent to the output, the values remaining in the pipe are shifted one to the right, and the new value is placed at the beginning of the pipe. The number of items in the pipe is determined by the size parameter.



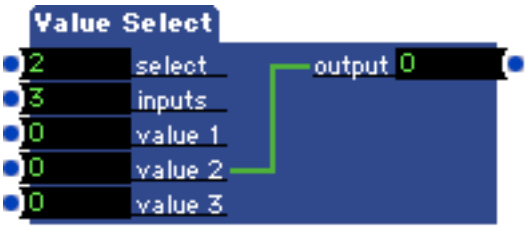
Input Properties

- **value**: Each time a new value arrives here, the values in the delay line are shifted one to the right. The value at the end of list is sent to the output.
- **size**: The number of stages in the delay.

Output Properties

- **value out**.: Each time a new value arrives at the value input, the values in the delay line are shifted one to the right. The value at the end of list is sent to this output.

Value Select



Route multiple numeric inputs to one output.

The Value Select actor will route data from one of several inputs to an output. When a particular value input is selected with the select parameter, any values that arrive on that input will immediately be sent to the output. In addition, whenever the select input changes and a new input is routed to the output, the current value of the newly selected input is sent to the output.

Note that the value inputs and output output of this actor are mutable. This means they will *all* change their type (integer, float, video, etc.) to match the first link made to one of these properties. Once a link has been made to any of the mutable properties, their types will remain fixed, based on that first connection, until all have been disconnected. Then the properties become mutable again.

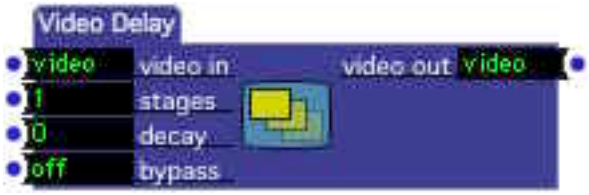
Input Properties

- **select**: Chooses which input will be routed to the output. This value can range between 1 and the number of inputs specified by the inputs property.
- **inputs**: The number of value inputs available to be routed to the output.
- **value 1, value 2, etc.**: The value inputs that will be routed to the output.

Output Properties

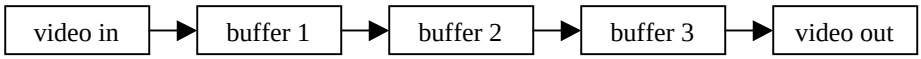
- **output**: Passes on any value arriving at the input to the output specified by the select input property.

Video Delay



Delays a video stream.

The Video Delay works by passing frames of video through a chain of video buffers called stages – the more stages, the longer the delay. Each time a new frame of video is received, it is stored at the front of the chain after all the other buffers are shifted to the right and the last buffer is sent to the video output.



Input Properties

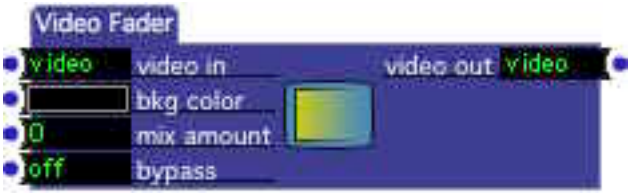
- **video in**: The video input stream.

- **stages**: The number of buffers used to delay the image. The more stages, the longer the delay.
- **decay**.: How much to darken each image as it goes from one stage to the next, from 0% to 100%. When this value is greater than zero, each frame of video is darkened (i.e., cross faded to black) as it pass from one stage to another. This is useful when implementing video feedback.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **video out**: The delayed video stream.

Video Fader



Fades between a video stream and a solid color.

Input Properties

- **video in**: The video input stream.
- **bkg color**: The color with which the video input stream will be faded. You can set this color by linking the Color Maker actor to this input property, or you can click on the value edit box and choose the color from within a Color Picker dialog box.
- **mix amount**.: Determines the mixture between the video input stream and the background color, from 0% to 100%. When set to 0, you see only the video input stream. As the value moves towards 100, you will see more of the background color.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

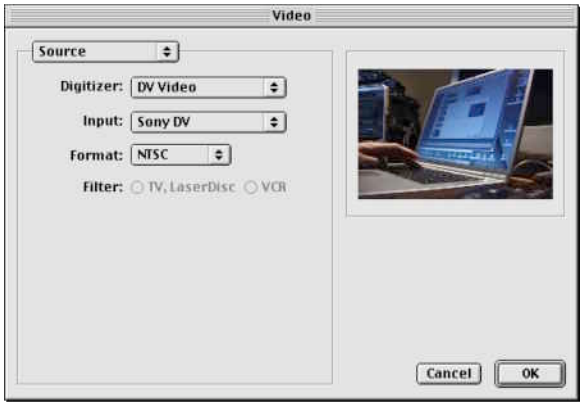
- **video out**: The mixed video stream.

Video In Watcher

Outputs a video stream captured from a live video source.

The Video In Watcher will deliver a video stream captured from a live source. To use this actor, you must have hardware that allows you to connect an external video camera to your computer, either in the form of a digital FireWire connection or a with standard composite video input. To get live video coming into *Isadora*, do the following:

- Connect the video camera to the input hardware, either your computer's FireWire port or the composite video input of your video capture hardware.
- Make sure you can actually see an image on the camera (i.e., look through the viewfinder.)
- Choose **Input > Enable Video Capture** to attempt to start capturing. If Isadora will notify you if it cannot find any video input sources. If you don't see any dialog box, then the computer successfully opened its video input port.
- Choose **Input > Video Input Settings**. If you see an image in the top right of the Capture Settings dialog box, then everything is ready to go.



If not, do the following: At the top of this dialog box you will see a drop-down menu. Click on it and choose **Source**. Then, experiment with the settings of the drop-down menus labeled *Digitizer* and *Input*. By adjusting these settings you should eventually see an image from your camera appear at the top right of the window.

Once an image can be seen coming from the camera, click the OK button to close the Video Capture dialog.

Note that you must choose **Enable Video Capture** each time you start Isadora before any video input will be available to the Video In Watcher.

Output Properties

- **video out**: The video input stream captured from the live input.
- **trigger**: Sends a trigger each time a new frame of video arrives.

Video Inverter

Inverts the color of a video stream.

The default behavior of the Video Inverter is to generate a negative image, i.e., like a photographic negative, of the video input stream. However, by changing the invert color, a wide range of bizarre (though unpredictable) colorization effects can be achieved. Connect the Color Maker actor to the invert color input to experiment with inversion colors other than white.

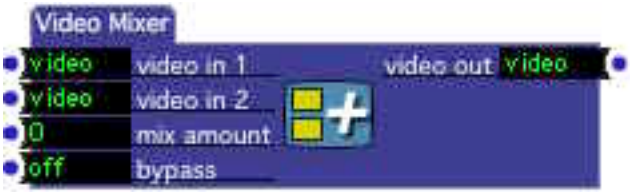
Input Properties

- **video in**: The video input stream.
- **invert color**: The color used to invert the video input stream. When set to white, the output is the photographic negative of the input. Other colors produce unpredictable though interesting results. You can set this color by linking the Color Maker actor to this property, or you can click on the value edit box and choose the color from within a Color Picker dialog box.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **video out**: The inverted video stream.

Video Mixer



Mixes two streams of video, allowing a crossfade between the two.

Input Properties

- **video in 1**: The first video input stream.
- **video in 2**: The second video input stream.
- **mix amount**.: Determines the mixture between the two video input streams, from 0% to 100%. When set to 0, you see only the first video input stream. As the

value moves towards 100, you will see more of the second stream. When the mix amount reaches 100, you will see only the second stream.

- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **video out**: The mixed video stream.

Video Noise

Generates video noise.

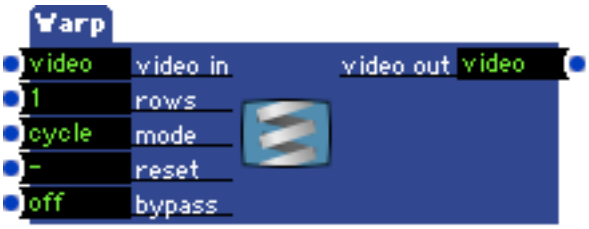
Input Properties

- **run/stop**: When turned on, this actor produces frames of video noise at the rate specified. When set to off, the actor does nothing.
- **rate**.: Determines the frequency with which new frames of video noise will be generated. Specified in Hertz (i.e., cycles per second.)
- **color**: When turned off, black and white video noise is produced. When turned on, the video noise is in color.

Output Properties

- **video out**: The video noise output.

Warp



Warps the input video stream.

It is easier to see the results of warp than to describe it. Warp works by copying one horizontal chunk of video from each new frame that arrives at the input. It starts the copying at the top, and moves down one chunk each time a new frame of video arrives. When it gets to the bottom, it starts over again.

Here is the result produced when moving the camera horizontally across this author's face and routing the video input into Warp:

I rotated my head 90 degrees about 2/3 of the way through one cycle, so there is a bit of profile after that.

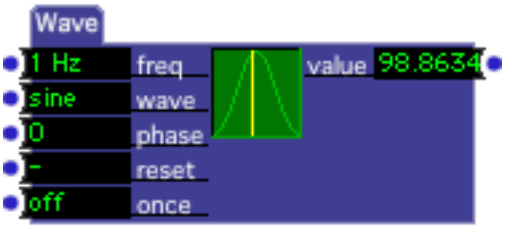
Input Properties

- **video in**: The video input stream.
- **rows**.: Determines the number of rows of video that will be copied each time a new frame of video arrives. Lower numbers look better, but are slower. Higher values are chunkier, but faster. Experiment for best results.
- **mode**.: When set to cycle, each time Warp gets to the bottom of the frame, it automatically jumps to the top and continues scanning continuously. When set to once, it stops upon reaching the bottom, and waits for a trigger at the reset input before it will return to the top and start scanning again.
- **reset**: When mode is set to once, a trigger sent to this input will start Warp scanning again after it has reached the bottom of the frame. (See mode property above for more details.)
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **video out**: The warped video output.

Wave Generator



Generates waves of various shapes.

The Wave Generator generates numeric output over time that represents one of five possible wave shapes: sine, square, triangle, sawtooth and random. For those who have worked with music synthesizers, this would be Isadora's equivalent to a Low Frequency Oscillator (LFO).

There numerous times that the Wave Generator comes in handy, but it is primarily used when parameter to cycle repeatedly over time.

- **freq**: The frequency of the wave, from 0.0001 to 999 Hz (or cycles per second).
- **wave**: One of five possible wave shapes: sine, square, triangle, sawtooth or random. When you choose a new wave, a diagram of it will appear inside the actor to help you visualize its shape. Random is a little different than the other waves, in that it will only output a new value each time it comes to the start of its cycle. The other waves output new values continuously during their cycle.
- **phase**: Normally, all waves start at the zero point of their cycle. You can change this by adjusting the phase of the wave. The diagram of the wave will slide as you change this value, so that you can see the wave's new starting point.
- **reset**: Starts generating the wave from its starting point, which is controlled by the **phase** input property. This input is also to restart the wave when its once property is turned on.
- **once**: If this property is turned *on* then the wave will go through only one cycle each time it receives a trigger on the reset input.

Output Properties

- **value**: The current value of the wave.

YUV to RGB (v1.1)

Converts a video stream from YUV to RGB.

This actor is used to explicitly convert a YUV video stream to RGB, usually to be fed to a video-processing actor that prefers RGB.

If the incoming stream is already RGB, then it is passed directly to the output.

See "YUV Video Processing" on page 130 for more information about using YUV mode in Isadora.

Input Properties

- **video in**: The YUV video stream to be converted to RGB.
- **video out**: The input video stream after conversion to RGB format.

Zoomer

Zooms in or out on source video stream, allowing you to pan left and right or up and down within the zoomed image, and to control the position of the resulting image within the output video stream.

Note that the two panning properties only have an effect when their corresponding zoom factors are "zoomed in" (i.e., greater than 100.) This is because, when the zoom factor is less than 100, you are seeing the entire source video image, so there is no place left to pan. When you zoom in you are using only a portion of the source video image, so there is some extra image left over. This remaining area is used to pan the image.

Input Properties

- **video in**: The video input stream.
- **horz zoom**: The horizontal zoom factor, from 0 to 1000 percent. 100% is normal, lower numbers zoom out, higher numbers zoom in.
- **vert zoom**: The vertical zoom factor, from 0 to 1000 percent. 100% is normal, lower numbers zoom out, higher numbers zoom in.
- **horz pan**: When zoomed in horizontally, pans left or right within the zoomed image. Values range from –100 to +100 –!negative numbers pan left, positive numbers pan right. Note that this property has no effect when the horz zoom property is 100 or less.
- **vert pan**: When zoomed in vertically, pans up or down within the zoomed image. Values range from –100 to +100 –!negative numbers pan up, positive numbers pan down. Note that this property has no effect when the vert zoom property is 100 or less.
- **horz center**: Determines the horizontal position of the zoomed image within the output video stream, with values ranging from –100% to +100% of the output frame width. Negative numbers move the image to the left, positive to the right.
- **vert center**: Determines the vertical position of the zoomed image within the output video stream, with values ranging from –100% to +100% of the output frame height. Negative numbers move the image to the left, positive to the right.

- **decay**: Darkens the image as it passes it through to the output, from 0 to 100 percent. When set to 0, this property has no effect. As you increase the value, the image will become darker. This property is most often used when Zoomer is combined with the Luminance Key actor to create video feedback effects.
- **bypass**: When turned off, this effect functions normally. When turned on, the effect is disabled and the video input is passed directly to the video output.

Output Properties

- **video out**: The zoomed video output.

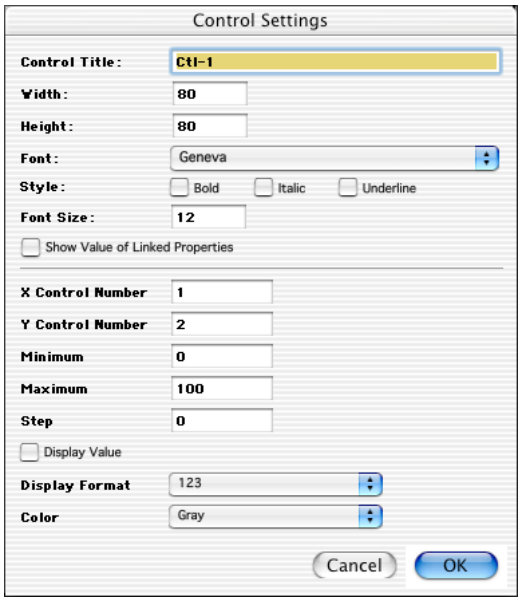
Controls Reference

2D Slider

Displays a two dimensional slider that can manipulate two parameters at once.

Sliders are most useful when you want to vary an actor's property over a range of possible values. The horizontal and vertical output can be linked to two different properties, and the output value can be displayed if desired.

Settings Dialog



Control Properties

- **Control Title**: The title used to identify this control, which appears inside the button.
- **Width**: The width of the slider.
- **Height**: The height of the slider.

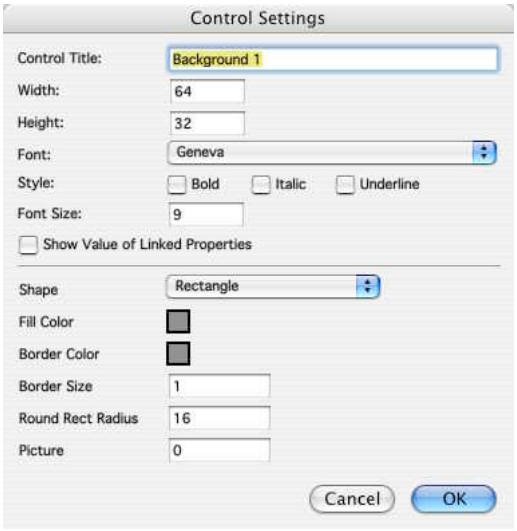
- **Font**: Popup menu selects the font used to draw text for this control.
- **Bold/Italic/Underline**: When checked, uses the bold, italic, or underline variations of the specified font.
- **Font Size**: Sets the size font used to draw text for this control.
- **Show Value of Linked Properties**: When an actor input property is linked to this control and this box is checked, the control's value will be set to match the property's value. This causes the control to display the property's current value at all times.
- **X Control ID**: This number is used to identify the control when linking it to actor properties. When this control's value changes because a user moves the indicator horizontally, a message giving the Control ID and the control's value is broadcast to the active Scene. Any actor properties that are linked to this Control ID will have their value set appropriately. Generally speaking, you will want this number to be unique within a given Control Panel.
- **Y Control ID**: Same as the X Control ID, except that it broadcasts the vertical movement of the indicator.
- **Minimum Value**: The minimum possible value for this slider. Can be any number. (It is permissible for the minimum value to be greater than the maximum. In this case the slider value will *decrease* as you move it from left to right or from bottom to top.)
- **Maximum Value**: The maximum possible value for this slider. Can be any number. (It is permissible for the maximum value to be less than the minimum. In this case the slider value will *decrease* as you move it from left to right or from bottom to top.)
- **Step**: Determines the minimum of the step between values. When *Step* is set to zero, this setting has no effect. When set to a value greater than zero, the control value will step by this amount as it goes from the *Minimum Value* to the *Maximum Value.* For example, if the minimum is set to 1, maximum is set to 10, and step is set to 1, the slider will have 10 discrete steps (1, 2, 3, … 8, 9, 10). Setting step to 1 may be the most common setting, as it allows you to send only integer values (i.e., no numbers after the decimal point) if desired. Note however that counting starts at the value given by the *Minimum Value* setting. If you set minimum to 1.5 and maximum to 10.5 in the example just given, the 10 steps would be 1.5, 2.5, 3.5…10.5.
- **Display Value**: When this box is checked, the slider will display its value as a number. Vertical sliders display this number at the bottom; Horizontal sliders display the number to the right.
- **Display Format**: Determines how the number is formatted when the *Display Value* parameter is turned on. There are three choices: *123*, *123.4*, or *123.45*. The first displays no decimal point, the second one number after the decimal point, and the third displays two. If *Display Value* is turned off, this setting has no effect.
- **Color**: The color of the control's background.

Background

Draws a solid background with a specified color and shape, optionally using a picture to draw the background.

The background color is used to visually organize your Isadora Control Panel. By placing other Isadora controls on these rectangular or oval areas of color, you can create an appealing look and feel for your

Settings Dialog

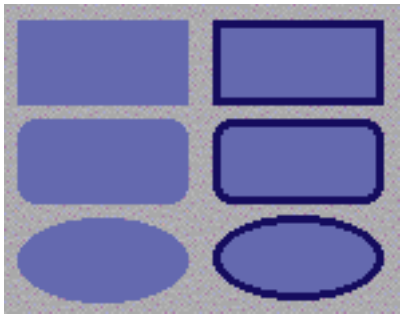


Control Properties

- **Control Title**: The title used to identify this control, which appears inside the button.
- **Width**: The width of the slider.
- **Height**: The height of the slider.
- **Font**: Popup menu selects the font used to draw text for this control.
- **Bold/Italic/Underline**: When checked, uses the bold, italic, or underline variations of the specified font.
- **Font Size**: Sets the size font used to draw text for this control.
- **Show Value of Linked Properties**: When an actor input property is linked to this control and this box is checked, the control's value will be set to match the property's value. This causes the control to display the property's current value at all times.
- **Shape (v1.1)**: Specifies the shape of the background from among seven possible options: Rectangle, Rounded Rectangle, Oval, the bordered versions of those

shapes, or a Picture – the latter allowing you to use a Picture from the Media Window to draw the background.

Here is a summary of the various shapes that are possible:



Rectangle/Border Rectangle
Round Rectangle, Border Round Rectangle
Oval, Border Oval

If you choose Picture, then the value of the Picture input determines the

- **Fill Color**: Determines the color of the background. To change the color, click on the colored box – a Color Picker dialog will appear. (If the Shape is set to Picture, this setting has no effect – v1.1)
- **Border Color**: Determines the color of the line around the border. This color is only used if you have chosen one of the bordered variations of the background shape. To change the color, click on the colored box – a Color Picker dialog will appear. (If the Shape is set to Picture, this setting has no effect – v1.1)
- **Border Size**: The size of the border in pixels. The border is only used if you have chosen one of the bordered variations of the background shape. (If the Shape is set to Picture, this setting has no effect – v1.1)
- **Round Rect Radius**: When the shape is either Round Rectangle or Border Round Rectangle, specifies the radius of the rounded corners in pixels. (If the Shape is set to Picture, this setting has no effect – v1.1)
- **Picture (v1.1)**: Set this to the media index of a Picture in the Media Window to use that image to draw this background. The picture will be scaled to fit the rectangle that encloses the background – to prevent scaling, set the Width and Height inputs to match the size of the picture. Note that any alpha channel information encoded into the picture is used when drawing the image, allowing you to create unusual shapes, drop shadows, etc.

Bin Picker

Picks media files grouped by bin.

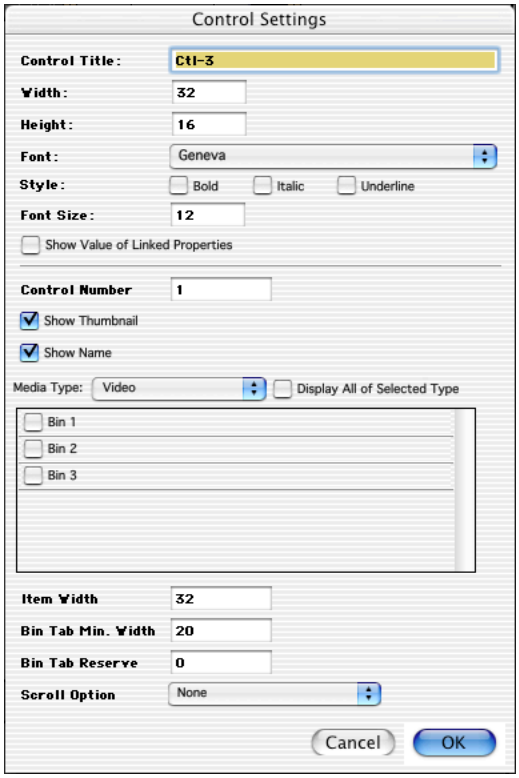
The Bin Picker works in conjunction with the one of the actors that allows you to play a media file (Movie Player, Sound Player, Picture Player, Midi Player, etc.). When you click on an item in the picker, the number of that file in the Media Window is sent to any input that is listening to this control.

The files seen in the picker are organized by bin. You choose which bins can be displayed by this control by editing the control's settings. Once you have done so, the names of the bins you selected will appear at the top of the control as buttons. The picker will only show the media files within one of the selected bins. You can quickly switch from one bin to another by clicking the bin buttons at the top of the control.

For movies and pictures, you have the option of showing a thumbnail, the movie's title, or both in the Bin Picker. For sounds and MIDI files, you can only display the name.

If all of the files that you have chosen for the picker cannot fit within the control's area, then you may optionally display scroll arrows, tabs, or both so that you can navigate through all of the possible movies.

Settings Dialog



Control Properties

- **Control Title**: The title used to identify this control.
- **Width**: The width of the picker.
- **Height**: The height of the picker.
- **Font**: Popup menu selects the font used to draw text for this control.
- **Bold/Italic/Underline**: When checked, uses the bold, italic, or underline variations of the specified font.
- **Font Size**: Sets the size font used to draw text for this control.
- **Show Value of Linked Properties**: When an actor input property is linked to this control and this box is checked, the control's value will be set to match the property's value. This causes the control to display the property's current value at all times.
- **Control ID**: This number is used to identify the control when linking it to actor properties. When this control's value changes because a user clicked in the control, a message giving the Control ID and the control's value is broadcast to the active Scene. Any actor properties that are linked to this Control ID will have their value set appropriately. Generally speaking, you will want this number to be unique within a given Control Panel.
- **Show Thumbnail**: If this checkbox is selected, a thumbnail of the media file will be drawn in the control if one is available.

- **Show Name**: If this checkbox is selected, the media file's name will be drawn in the control.
- **Media Type**: Determines which type of media file the picker will display: Video, Audio, Pictures or MIDI Files.
- **Show All of Selected Type**: If this option is enabled, the picker will display all bins of the selected type, as chosen by the Media Type popup. When this option is on, the Bin Selector below will be gray to show it is disabled.
- **Bin Selector**: Once you have chosen the type of media file you want to display in the Media Type popup menu, all available bins of that type will appear in this area. To allow a bin to be chosen, check the box to the left of its name.
- **Item Width**: Set the width of each item within the picker in pixels. The minimum width is 16.
- **Bin Tab Min. Width**: Sets the minimum width for a bin selector tab at the top of the picker.
- **Bin Tab Reserve**: Setting this to a non-zero value will ensure that the specified number of pixels are always available for the bin tabs at the top of the picker. This option is most useful when the Show All of Selected Type option is on, because you can ensure that there is always enough vertical space for the bin tabs as you add more bins.
- **Scroll Option**: There are five possible options: **None**, **Tabs/Top**, **Tabs/Bottom**, **Tabs+Arrows/Top**, and **Tabs+Arrows/Bottom**. The top and bottom versions determine if the tabs and/or arrows appear at the top or bottom of the control. The **Tabs** only versions does not display left and right scroll arrows, the **Tabs+Arrows** version display both.

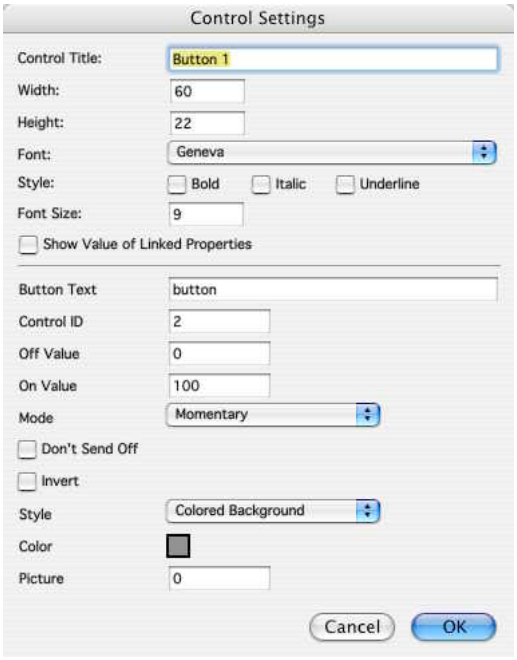
  The number of movies that you can see at once and the number of tabs will update dynamically as you resize your control – adjust the picker's size for the orientation/arrangement that suits you best. Note that if there is not enough room horizontally, all of the possible tabs might not be displayed.

Button

Displays an on/off button that sends one value when turned on, and another when turned off.

The button control is most useful when you need to trigger actors to do something, or toggle their state between two values. You can choose to display the buttons in a number of colors and styles to help organize your interface.

Settings Dialog



Control Properties

- **Control Title**: The title used to identify this control. This text appears inside the button.
- **Width**: The width of the button.
- **Height**: The height of the button.
- **Font**: Popup menu selects the font used to draw text for this control.
- **Bold/Italic/Underline**: When checked, uses the bold, italic, or underline variations of the specified font.
- **Font Size**: Sets the size font used to draw text for this control.

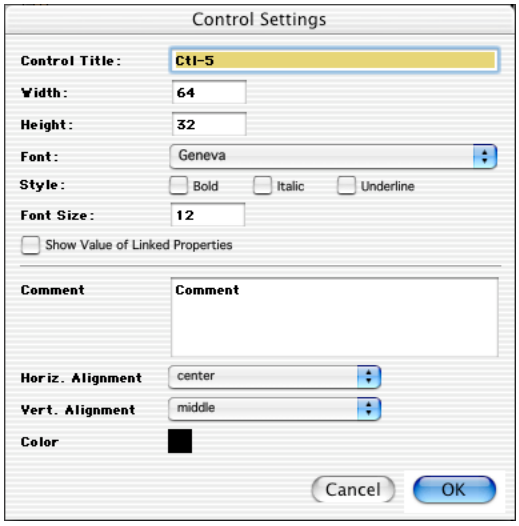
- **Show Value of Linked Properties**: When an actor input property is linked to this control and this box is checked, the control's value will be set to match the property's value. This causes the control to display the property's current value at all times.
- **Control ID**: This number is used to identify the control when linking it to actor properties. When this control's value changes because a user clicked in the control, a message giving the Control ID and the control's value is broadcast to the active Scene. Any actor properties that are linked to this Control ID will have their value set appropriately. Generally speaking, you will want this number to be unique within a given Control Panel.
- **Off Value**: The value that is broadcast to the currently active Scene when the button is turned off.
- **On Value**: The value that is broadcast to the currently active Scene when the button is turned on.
- **Mode**: When set to *Momentary*, the button goes to the on state when you click it, and back to the off state when the mouse is released. When set to *Toggle*, the button goes between on and off each time it is clicked.
- **Don't Send Off**: When this box is set, the off value is never sent. This is useful when you want a link this button to an actor property that expects a trigger input, as it prevents a trigger when the button turns off.
- **Style**: When set to *Colored Background*, the color specified by the **Color** drop-down menu determines the background color of the control. When set to *Colored Indicator* the background is always gray and the **Color** drop-down menu determines the color of the on/off indicator in the control.
- **Color**: The color of the control's background or its indicator, depending on the *Style* setting– see *Style* above for more information. To change the color, click on the colored box. A Color Picker control will appear, allowing you to select the color. Note: if you are using a Picture to draw your button (see below) this setting has no effect (v1.1).
- **Picture (v1.1):** Set this to the media index of a Picture in the Media window to provide a custom image for your button. The image should is divided into two parts when drawing the button: the top half is used to draw the button in its up state, while the bottom half is used to draw the button in its down state. For example, consider the image below which is 100 pixels across and 100 pixels high. The top 50 pixels will be used to draw the button in its up state, the lower 50 pixels used to draw it in its down state.

The picture will be scaled to fit the rectangle that encloses the slider. To prevent scaling, set the width to match the width of the picture, and the height to one-half the height of the picture. Note that any alpha channel information encoded into the picture is used when drawing the image on its background. This means that you can create unusually shaped buttons with drop shadows, etc.

Comment

Displays comments or titles in your user interface.

Settings Dialog



Control Properties

- **Control Title**: The title used to reference this control.
- **Width**: The width of the box enclosing the comment text.
- **Height**: The height of the box enclosing the comment text.
- **Font**: Popup menu selects the font used to draw text for this control.
- **Bold/Italic/Underline**: When checked, uses the bold, italic, or underline variations of the specified font.
- **Font Size**: Sets the size font used to draw text for this control.
- **Show Value of Linked Properties**: Not applicable
- **Font Size**: This size of the font used to draw the comment, in points.
- **Comment**: The comment text that will appear inside the control.
- **Horiz. Alignment**: The horizontal alignment of the text within its bounding box. Choices are left, middle and right.

- **Vert. Alignment**: The vertical alignment of the text within its bounding box. Choices are top, middle and bottom.
- **Color**: The color of the text. To change the color, click on the colored box. A Color Picker control will appear, allowing you to choose a new color.

Dial (v1.1)

Displays a dial that sends a continuous range of values.

Dials are most useful when you want to vary an actor's property over a range of possible values.

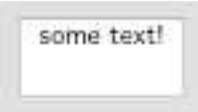
Settings Dialog

Control Properties

- **Control Title**: The title used to identify this control, which appears inside the button.
- **Width**: The width of the slider. Note that if the slider is wider than it is tall, the slider is horizontal and its indicator will move from left to right. If the slider is taller than it is wide, it is vertical and its indicator will move up and down.
- **Height**: The height of the slider.
- **Font**: Popup menu selects the font used to draw text for this control.

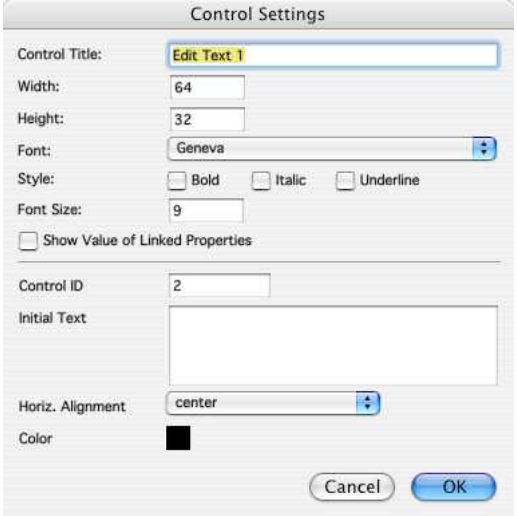
- **Bold/Italic/Underline**: When checked, uses the bold, italic, or underline variations of the specified font.
- **Font Size**: Sets the size font used to draw text for this control.
- **Show Value of Linked Properties**: When an actor input property is linked to this control and this box is checked, the control's value will be set to match the property's value. This causes the control to display the property's current value at all times.
- **Control ID**: This number is used to identify the control when linking it to actor properties. When this control's value changes because a user clicked in the control, a message giving the Control ID and the control's value is broadcast to the active Scene. Any actor properties that are linked to this Control ID will have their value set appropriately. Generally speaking, you will want this number to be unique within a given Control Panel.
- **Minimum**: The minimum possible value for this dial. Can be any number. (It is permissible for the minimum value to be greater than the maximum. In this case the slider value will *decrease* as you move it from left to right or from bottom to top.)
- **Maximum** : The maximum possible value for this dial. Can be any number. (It is permissible for the maximum value to be less than the minimum. In this case the slider value will *decrease* as you move it from left to right or from bottom to top.)
- **Step**: Determines the minimum of the step between values. When *Step* is set to zero, this setting has no effect. When set to a value greater than zero, the control value will step by this amount as it goes from the *Minimum Value* to the *Maximum Value.* For example, if the minimum is set to 1, maximum is set to 10, and step is set to 1, the slider will have 10 discrete steps (1, 2, 3, … 8, 9, 10). Setting step to 1 may be the most common setting, as it allows you to send only integer values (i.e., no numbers after the decimal point) if desired. Note however that counting starts at the value given by the *Minimum Value* setting. If you set minimum to 1.5 and maximum to 10.5 in the example just given, the 10 steps would be 1.5, 2.5, 3.5…10.5.
- **Dial Size**: The graphic of the dial comes in four sizes: tiny, small, medium and large.
- **Show Dots**: When checked, small white dots will outline the range of the dial.
- **Display Value**: When this box is checked, the slider will display its value as a number. Vertical sliders display this number at the bottom; Horizontal sliders display the number to the right.
- **Display Format**: Determines how the number is formatted when the *Display Value* parameter is turned on. There are three choices: *123*, *123.4*, or *123.45*. The first displays no decimal point, the second one number after the decimal point, and the third displays two. If *Display Value* is turned off, this setting has no effect.
- **Color**: Sets color of the dial. When you click the color box, a Color Picker control will appear, allowing you to choose the new color.

Edit Text (v1.1)



Allows the user to enter text, which can be sent to any property input that accepts a string.

Settings Dialog



Control Properties

- **Control Title**: The title used to identify this control, which appears inside the button.
- **Width**: The width of the number control.
- **Height**: The height of the number control.
- **Font**: Popup menu selects the font used to draw text for this control.
- **Bold/Italic/Underline**: When checked, uses the bold, italic, or underline variations of the specified font.
- **Font Size**: Sets the size font used to draw text for this control.
- **Show Value of Linked Properties**: This setting has no effect for the Monitor Actor.
- **Control ID**: This number is used to identify the control when linking it to actor properties. When this control's value changes because a user clicked in the control, a message giving the Control ID and the control's value is broadcast to the active Scene. Any actor properties that are linked to this Control ID will have their value set appropriately. Generally speaking, you will want this number to be unique within a given Control Panel.
- **Initial Text**: The text field will be initialized to this text when the Control Panel is first loaded.

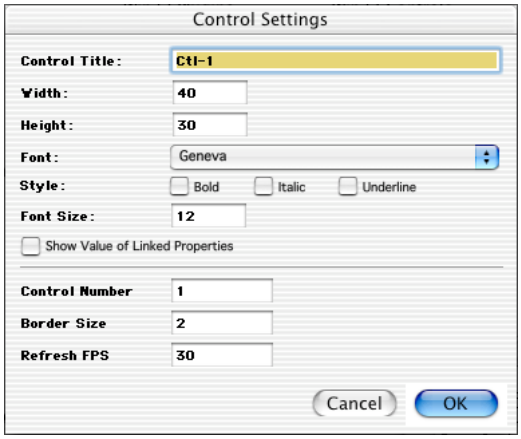
- **Color**: Sets color of the text. When you click the color box, a Color Picker control will appear, allowing you to choose the new color.

Monitor

Provides monitoring of video streams in the control panel.

By linking this control to a video out port of an actor, you can monitor the video at that point in the Scene.

Settings Dialog



Control Properties

- **Control Title**: The title used to identify this control, which appears inside the button.
- **Width**: The width of the monitor.
- **Height**: The height of the monitor.
- **Font**: This setting has no effect for the Monitor control.
- **Bold/Italic/Underline**: These settings have no effect for the Monitor control.
- **Font Size**: This setting has no effect for the Monitor control.
- **Show Value of Linked Properties**: This setting has no effect for the control Actor.
- **Control ID**: To see the video coming out of a particular actor, set its Control Link to match the Control ID specified here. Note that if more than one actor's video output is linked to this Monitor, you may get unpredictable, flashing images.

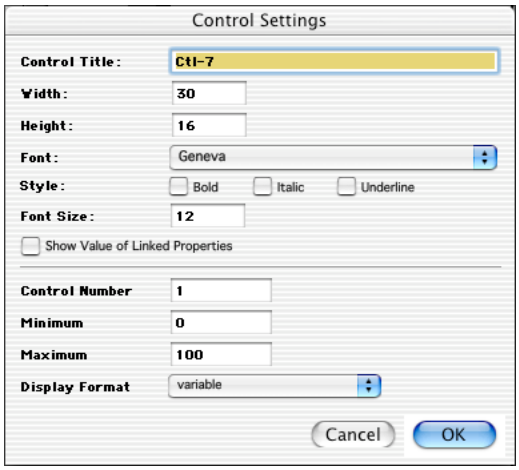
- **Border Size**: The width of the border around the monitor display, specified in pixels.
- **Refresh FPS**: Determines how fast the Monitor image is updated. It takes a certain amount of processor power to scale the video image to fit into the Monitor control. To reduce the amount of processor power consumed by this control, set this number to a value less than 30.

Number

Allows the user to enter a numeric value

By linking this control to a video out port of an actor, you can monitor the video at that point in the Scene.

Settings Dialog



Control Properties

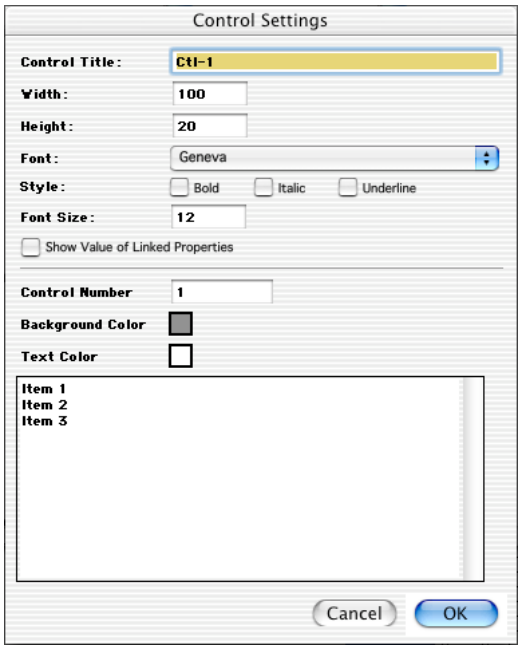
- **Control Title**: The title used to identify this control, which appears inside the button.
- **Width**: The width of the number control.
- **Height**: The height of the number control.
- **Font**: Popup menu selects the font used to draw text for this control.
- **Bold/Italic/Underline**: When checked, uses the bold, italic, or underline variations of the specified font.
- **Font Size**: Sets the size font used to draw text for this control.
- **Show Value of Linked Properties**: This setting has no effect for the Monitor Actor.

- **Control ID**: This number is used to identify the control when linking it to actor properties. When this control's value changes because a user clicked in the control, a message giving the Control ID and the control's value is broadcast to the active Scene. Any actor properties that are linked to this Control ID will have their value set appropriately. Generally speaking, you will want this number to be unique within a given Control Panel.
- **Minimum Value**: The minimum possible value for this number. Can be any number.
- **Maximum Value**: The maximum possible value for this slider. Can be any number.
- **Display Format**: There are four choices: *variable*, *123*, *123.4*, or *123.45*: *various* will display as many decimal points as needed, *123* displays no decimal point, *123.4* shows one number after the decimal point, and *123.45* shows two numbers after the decimal.

Popup Menu

Allows the user to select an item from a list contained in a pop up menu.

Settings Dialog



Control Properties

- **Control Title**: The title used to identify this control, which appears inside the button.

- **Width**: The width of the number control.
- **Height**: The height of the number control.
- **Font**: Popup menu selects the font used to draw text for this control.
- **Bold/Italic/Underline**: When checked, uses the bold, italic, or underline variations of the specified font.
- **Font Size**: Sets the size font used to draw text for this control.
- **Show Value of Linked Properties**: This setting has no effect for the Monitor Actor.
- **Control ID**: This number is used to identify the control when linking it to actor properties. When this control's value changes because a user clicked in the control, a message giving the Control ID and the control's value is broadcast to the active Scene. Any actor properties that are linked to this Control ID will have their value set appropriately. Generally speaking, you will want this number to be unique within a given Control Panel.
- **Background Color**: The background color of the popup menu.
- **Text Color**: The color of the text drawn inside the popup menu.
- **Items**: The items that will be displayed in the pop up menu. Enter one line for each item you want to display. The example above will show three items labeled Item 1, Item 2 and Item 3.

Slider

Displays a horizontal or vertical slider that sends a continuous range of values.

Sliders are most useful when you want to vary an actor's property over a range of possible values. The sliders can be either horizontal or vertical, and can display their current value as a number if desired.

Settings Dialog

Control Properties

- **Control Title**: The title used to identify this control, which appears inside the button.
- **Width**: The width of the slider. Note that if the slider is wider than it is tall, the slider is horizontal and its indicator will move from left to right. If the slider is taller than it is wide, it is vertical and its indicator will move up and down.
- **Height**: The height of the slider.
- **Font**: Popup menu selects the font used to draw text for this control.
- **Bold/Italic/Underline**: When checked, uses the bold, italic, or underline variations of the specified font.
- **Font Size**: Sets the size font used to draw text for this control.
- **Show Value of Linked Properties**: When an actor input property is linked to this control and this box is checked, the control's value will be set to match the property's value. This causes the control to display the property's current value at all times.
- **Control ID**: This number is used to identify the control when linking it to actor properties. When this control's value changes because a user clicked in the control, a message giving the Control ID and the control's value is broadcast to the active Scene. Any actor properties that are linked to this Control ID will have their value set appropriately. Generally speaking, you will want this number to be unique within a given Control Panel.
- **Minimum Value**: The minimum possible value for this slider. Can be any number. (It is permissible for the minimum value to be greater than the maximum. In this case the slider value will *decrease* as you move it from left to right or from bottom to top.)

- **Maximum Value**: The maximum possible value for this slider. Can be any number. (It is permissible for the maximum value to be less than the minimum. In this case the slider value will *decrease* as you move it from left to right or from bottom to top.)
- **Step**: Determines the minimum of the step between values. When *Step* is set to zero, this setting has no effect. When set to a value greater than zero, the control value will step by this amount as it goes from the *Minimum Value* to the *Maximum Value.* For example, if the minimum is set to 1, maximum is set to 10, and step is set to 1, the slider will have 10 discrete steps (1, 2, 3, … 8, 9, 10). Setting step to 1 may be the most common setting, as it allows you to send only integer values (i.e., no numbers after the decimal point) if desired. Note however that counting starts at the value given by the *Minimum Value* setting. If you set minimum to 1.5 and maximum to 10.5 in the example just given, the 10 steps would be 1.5, 2.5, 3.5…10.5.
- **Display Value**: When this box is checked, the slider will display its value as a number. Vertical sliders display this number at the bottom; Horizontal sliders display the number to the right.
- **Display Format**: Determines how the number is formatted when the *Display Value* parameter is turned on. There are three choices: *123*, *123.4*, or *123.45*. The first displays no decimal point, the second one number after the decimal point, and the third displays two. If *Display Value* is turned off, this setting has no effect.
- **Color**: Sets color of the slider. The color you choose will be the color of the indicator – the background of the slider will be a darker shade of the same color. To change the color, click on the colored box. A Color Picker control will appear, allowing you to choose a new color. Note: if you are using a Picture to draw your button (see below) this setting has no effect (v1.1).
- **Background Picture (v1.1):** Set this to the media index of a Picture in the Media window to provide a custom background for your slider. The picture will be scaled to fit the rectangle that encloses the slider – to prevent scaling, set the width and height inputs to match the size of the picture. Note that any alpha channel information encoded into the picture is used when drawing the image on its background, allowing you to create unusual shapes, drop shadows, etc.
- **Thumb Picture (v1.1):** Set this to the media index of a Picture in the Media window to provide a custom "thumb" (the moving indicator) for your slider. If the slider is horizontal, the thumb will be scaled vertically to match the height of the slider, but the width will remain unchanged. If the slider is vertical, the thumb will be scaled horizontally to match the width of the slider, but the height will not be changed. Note that any alpha channel information encoded into the picture is used when drawing the image on its background, allowing you to create unusual shapes, drop shadows, etc.

Video Picker

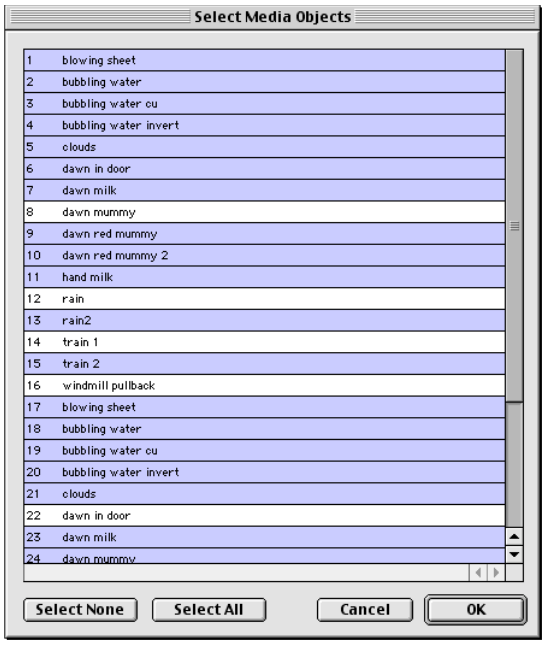
Allows the user to pick a movie from a group of movies that you select.

NOTE: The functionality of the Video Picker has been superseded by the more powerful Bin Picker control. We recommend that you use the Bin Picker for any newly created files.

The Movie Picker works in conjunction with the **movie** input of the Movie Player, Movie Player Direct or Movie Player VR actors. When you click on a movie in the picker, the number of that movie in the Media Window is sent to any input that is listening to this control.

You have the option of showing a thumbnail, the movie's title, or both in the Movie Picker. If all of the files that you have chosen for the picker cannot fit within the control's area, then you may optionally display scroll arrows, tabs, or both so that you can navigate through all of the possible movies.

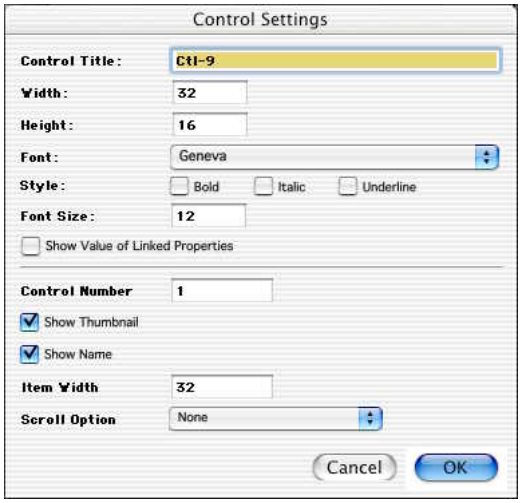
To prepare this control to be used, you must first select the movies that it will display. To do this, select the control and choose **Controls > Control Specific Options…** The following dialog will appear:



In it you will find listed all of the movies currently in the Media Window. To include a movie in the picker, click on it to select it. Use shift-click to select a group of movies, or cmd-click to toggle the selection of an individual movie. You may also click the “Select All” button to select all of the movies, or “Select None” to deselect all of them.

Once you the movies that you want the picker to display are selected, click OK.

Settings Dialog



Control Properties

- **Control Title**: The title used to identify this control.
- **Width**: The width of the picker.
- **Height**: The height of the picker.
- **Font**: Popup menu selects the font used to draw text for this control.

- **Bold/Italic/Underline**: When checked, uses the bold, italic, or underline variations of the specified font.
- **Font Size**: Sets the size font used to draw text for this control.
- **Show Value of Linked Properties**: When an actor input property is linked to this control and this box is checked, the control's value will be set to match the property's value. This causes the control to display the property's current value at all times.
- **Control ID**: This number is used to identify the control when linking it to actor properties. When this control's value changes because a user clicked in the control, a message giving the Control ID and the control's value is broadcast to the active Scene. Any actor properties that are linked to this Control ID will have their value set appropriately. Generally speaking, you will want this number to be unique within a given Control Panel.
- **Show Thumbnail**: If this checkbox is selected, a thumbnail of the Movie file will be drawn in the control.
- **Show Title**: If this checkbox is selected, the Movie's title will be drawn in the control.
- **Item Width**: Set the width of each item within the picker in pixels. The minimum width is 16.
- **Scroll Option**: There are five possible options: **None**, **Tabs/Top**, **Tabs/Bottom**, **Tabs+Arrows/Top**, and **Tabs+Arrows/Bottom**. The top and bottom versions determine if the tabs and/or arrows appear at the top or bottom of the control. The **Tabs** only versions does not display left and right scroll arrows, the **Tabs+Arrows** version display both.

  The number of movies that you can see at once and the number of tabs will update dynamically as you resize your control – adjust the picker's size for the orientation/arrangement that suits you best. Note that if there is not enough room horizontally, all of the possible tabs might not be displayed.